ENGINEERING NEWS

——THE NICARAGUA CANAL BILL has now passed the House also, but loaded with amendments, which provide that an explicit printed waiver of governmental responsibility shall be on every bond or other obligation; that no certificates shall be issued until 10 per cent. in cash has been paid in, nor assigned until fully paid up, and more monstrous than all, that Congress shall have the right to alter, amend or repeal the Act, and to regulate all tolls on an enterprise which is neither within its jurisdiction nor aided or supported by it, which latter provision passed by 83 to 80. The bill now goes to a conference committee of the Senate and House, and it is probable that the more objectionable details will be eliminated.

——A HIGH-PRESSURE WATER SERVICE is projected for Chicago, by Mayor ROCHE. Briefly outlined the scheme means the laying of a special pipe system and the delivery of water under a pressure sufficient to furnish hydraulic power in the many high buildings of that city. There are now in Chicago 600 hydraulic elevators in operation, consuming 50,000 galls. of water per day each, or 30,000,000 galls. in the aggregate. All this power could in time be supplied by the city, and the mayor thinks that an average price of $50 per month, or $360,000 per annum, could be collected, with a net profit to the city of from $200,000 to $250,000. The system would be the same as now in use in London, Liverpool, Manchester and other English cities, with a pressure in some cases equaling 750 lbs. per square inch. The estimated cost of the plant is as follows: 12 miles of service pipe, $500,000; shaft and tunnel to the lake, $30,000; modifying a new engine now under contract, $1,000 over original cost, and additional engine and boilers, $100,000. The sum of $500,000 would give a 6 mile service and "the city could sell for $2 what costs it 75 cts."

——THE COMPLETION OF THE PANAMA CANAL, it is suggested by London *Engineering*, might be accomplished by "a combination of French and American capital with its affairs controlled by a joint board of directors." As in the same issue *Engineering* estimates this completion to demand a fresh capital of $100,000,000 on top of the $230,000,000 now expended, Americans had better build their own canal at Nicaragua for $70,000,000, save money, and avoid French complication. As the estimate of our contemporary is for a lock-canal, the Nicaraguan route would have many advantages over the Panama line, and avoid the death-dealing feature of the latter route which *Engineering* says has been one of the chief causes of unlooked-for expenditure. But as it will cost much nearer $150,000,000, than the sum given above, to complete the canal at Panama on any working basis, it will hardly attract American capital.

——STATISTICS REGARDING ROLLING STOCK CONSTRUCTION in the United States and Canada during 1888 have been collected by the *Railroad Gazette*, showing a total for the year of 2,562 locomotives, 82,190 freight cars and 2,471 passenger cars. These figures were based on returns from 17 locomotive builders, 36 car builders, and 66 railroad companies. The figures for locomotive building are believed to include practically all the year's output; and for the car building, though "it is impossible to say what percentage of the output of the year the figures represent, it must be a very large part of the whole." The details of locomotive building were as follows:

Built by 17 private firms	2,180
" " 66 railway companies	382

One firm built over 700. The second largest output was 301. One other firm built over 200, and four others between one and two hundred.

In car construction, 1888 and 1887, are contrasted as follows:

1887	passenger	freight
Built by 15 firms	561	23,775
" " 29 railway companies	169	6,426
Total	730	30,201
1888		
Built by 36 firms	1,954	62,280
" " 66 railway companies	517	19,910
Total	2,471	82,190

The incompleteness of the statistics makes comparison difficult, but the *Gazette* concludes that the output of 1888 was on the whole nearly, if not quite, equal to that of the preceding year.

——THE MOST SERIOUS RAILWAY ACCIDENT of the week was the derailment on Jan. 6, of an Illinois Central passenger train by an open switch at Cedar Hill, Miss. Five cars were derailed, one of them being turned over and the others thrown across the track. No one was killed.——A rear collision between two Union Pacific freight trains occurred Jan. 3 on a trestle near Carbon, Wyo. The engine of the rear train was overturned and the bridge and several cars were burnt. The first train had been stopped on account of a hot box, and a flagman was sent back, but the engineer of the following train did not see him. Two men were injured, one fatally.

——A CYCLONE did destructive work in Pennsylvania on Jan. 9. Buildings were wrecked and other damage done in Reading, Altoona, Harrisburg, Pittsburg and other places. It is estimated that between 100 and 150 lives were lost. The comparative small loss of live caused by railway accidents, as compared with the records of other classes of accidents, is again shown by these figures. ——Heavy storms of rain and wind have also occurred in New York State.

——LANDSLIDES have occurred on the Pennsylvania Railroad near Wilkesbarre, and at the Iowa approach to the new Missouri river bridge at Sioux City, Ia.; in the latter a switch engine was nearly buried in the debris.

——BRIDGE ACCIDENTS are reported as follows: at Milltown, N. J., on Jan. 6, the Milltown river bridge which was being built for the Raritan River Railway, was carried away by a flood. The structure was 50 ft. long and 30 ft. high.——On Jan. 9 the roadway suspension bridge over the Niagara river, below the falls, was completely wrecked by the wind, only the towers being left standing. The bridge was opened in 1869; in 1884 the wooden towers were replaced with steel, and in 1887 the bridge was widened and improved. It was 1,368 ft. long and 190 ft. above the water. The loss will amount to $90,000.

——EARTHQUAKE SHOCKS are reported as follows On Dec. 28 a shock was felt in Hampshire, England. On Dec. 29 and 30 a series of severe shocks were felt at San José de Costa Rica. The shocks are believed to have originated in the volcano of Poase, 6 leagues distant from the town. At Alajuela, 8 persons were killed and many injured. The churches and principal buildings in the city suffered considerable damage. The inhabitants encamped in the squares and parks.—On Jan. 3 severe shocks occurred at Khojend and Kastakos, in Turkestan. Many people were killed, and a number of buildings destroyed.

——THE CONFERENCE OF WESTERN RAILWAY PRESIDENTS held in New York on Jan. 8 and 10, was the most notable of recent events in railway and financial circles. The systems represented by their Presidents or Vice-Presidents were the Union Pacific; Chicago, St. Paul & Kansas City; Missouri Pacific; Chicago, Rock Island & Pacific; Chicago, Burlington & Quincy; Chicago, Milwaukee & St. Paul; Atchison, Topeka & Santa Fé and Chicago & Northwestern. C. P. HUNTINGTON of the Southern Pacific was unable to be present but is reported to be in hearty accord with the purpose of the meeting. Altogether over 35,000 miles of railway systems were represented. A committee was appointed with CHARLES FRANCIS ADAMS as Chairman to formulate a plan for concentrating the rate making power and preventing further loss of revenue. According to the official statement, "The Presidents were unanimous in the expression of the necessity of a strict enforcement of the Inter-State Commerce act. A unanimous invitation was extended to the trunk line Presidents to join and take part in the conference on Thursday."

At the meeting on Thursday the committee reported a plan, the chief features of which are the strict enforcement of the Interstate Commerce law, strict adherence to the "Agreement of Presidents of Jan. 1, 1889" and the formation of "The Interstate Railway Association" in which it will be attempted to include the Presidents of all the principal railway systems. Quoting from the plan submitted by the committee, "The intention is that the bidding for business by means of private concessions shall cease, and that the divisions on corresponding traffic, under similar circumstances as to receipt and delivery, shall be open to and alike *via* all lines." Joint agencies are to be established, commissions in every form are to be done away with, and an Auditor is to be chosen, and vested with full power to examine all accounts of any company member of the Association.

The weak point seems to be that some prominent companies, notably the Chicago & Alton, have not yet agreed to take part in the movement. Every effort is to be made at once to secure their co-operation. An important point has been scored by securing the approval of the Interstate Commerce Commission to the adopted plan. With this important point settled, the strong effort toward harmony and co operation seems likely to achieve success.

——THE OHIO RIVER BRIDGE, at Cincinnati, is now open and regular trains are running over it. Mr. JOHN S DEANS, Engineer for the Phœnix Bridge Co., who had immediate charge of the design and details in the office, and general direction of the erection, will close his connection with the bridge and return to Phœnixville about Feb. 1.

——THE NEW YORK STATE CANALS cost last year $742,263.45, for running expenses and ordinary repairs. The tonnage for the past 5 years is reported as follows 1884, 5,009,488; 1885, 4,731,784; 1886, 5,293,982; 1887, 5,553,805 1888, 4,942,948. Mr. SHANAHAN says that the lengthening of lock 46 would give a continuous stretch of improved canal 157.8 miles long; and lengthening locks 65 and 66 would give another stretch of 97.4 miles; the same work at the 3 Newark locks, 57, 58, 59, would connect the above lengths into one of 255.5 miles. In the Hudson river there is now a channel 140 ft. wide and 10 ft. deep at low tide from Troy to Albany, an increase of 15 ft. in width and 2 ft. in depth over former years. From Albany to Coxsackie the channel is 175 ft. wide and 11 ft. deep, an increase of 25 ft. and 1 ft.

——PANAMA CANAL NEWS, of Jan. 4, says that work on the canal is being lessened daily, and great uneasiness prevails as to the effect of totally throwing out of employment some thousand of workmen now there. The Colombian Government is taking measures to severely check any disorder.

——MAYOR CHAPIN of Brooklyn begins the work of preparing the public mind for the construction of a new East River bridge in the following words, extracted from his late message: "All these things [various expenditures] can be attained and our constitutional right to issue debt will still be sufficient to build a second bridge at an early day. Such an improvement cannot be long postponed. New York City will not long endure its own lack of means of transit. When such work is completed, Brooklyn's growth may receive a slight check. It is, however, entirely practicable to avoid such a result. It is proper, therefore, in all plans for the future, to bear in mind the probable early need of using the City's credit to pay for its part of the construction of a second East River bridge."

It would appear that, in some minds at least, on whom Mayor CHAPIN relies for advice perhaps, a big bridge contract for a new East River bridge is looming up in the future which perhaps explains the sudden suspension of all effort to increase to the utmost the capacity of the present bridge. Before any new bridge is built, however, at least with public money, there is likely to be a much more thorough ventilation than has yet been made of these possibilities, and of the causes which have led to their neglect, while, even if a new bridge were built across Blackwell's Island, or even at Grand St., though it would undoubtedly have a good traffic, it would do little to relieve the pressure of traffic on the present bridge.

——THE PANAMA CANAL RESOLUTION was passed by the Senate Jan. 7 by a vote of 49 to 3 in the following words:

"*Resolved*, by the Senate and House of Representatives in Congress assembled; That the Government of the United States will look with serious concern and disapproval upon any connection of any European Government with the construction or control of any ship canal across the Isthmus of Darien or across Central America; and must regard any such connection or control as injurious to the just rights and interests of the United States and as a menace to their welfare.

"*Resolved*, That the President of the United States be requested to communicate this expression of the views of *the Government of the United States* to the governments of the countries of Europe." Resolutions passed.

The last two lines read originally "the views of *Congress*", etc., which was amended by inserting the italicized words so as to make the resolution an expression of the views of the President likewise. The 3 dissenting votes are stated to have been based upon objections to the last clause only, as verging on an encroachment upon the constitutional prerogatives of the President.

——A LARGE DRY DOCK is wanted in Boston, Mass. Of the three public docks in that city the largest is 355 ft long by 68 ft. wide, and 19 ft. deep. The Navy-yard dock is larger, but can not take a Cunarder, nor one of the late iron-clads built by the Government. A dock 700 ft. long and wide and deep in proportion is now needed, and the Boston *Globe* suggests that the Simpson dock in East Boston could be enlarged to this length for about $300,000

——EGYPTIAN IRRIGATION schemes are being pushed under Sir COLIN SCOTT MONTCRIEFF. The $5,000,000 granted 4 years ago for this purpose is about exhausted: and it is estimated that $1,500,000 annually for the next 10 years will be required to enable the Government to repair all the old canals and open the new ones required to extend the area of cultivation. Sir SCOTT pronounces the scheme of Mr. R. COPE WHITEHOUSE for restoring the ancient reservoir in the Fayum district not only practicable but useful, and he says that the execution of this work would bring many thousands of acres of land under cultivation. Mr. WHITEHOUSE has not yet succeeded in obtaining the permission of the Government to inaugurate the work, for which capital is already assured.

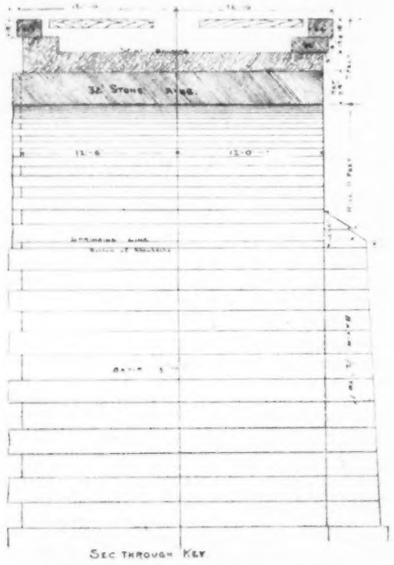
——PANAMA CANAL BONDHOLDERS have offered M. DE LESSEPS the chairmanship of a new canal company to be formed by shareholders in the present company. Gen BOULANGER has assured a deputation of bondholders of "his support"—whatever that may be worth. He subscribed for 25 additional shares of canal stock, which act was also very French.

——STILL ANOTHER STEAMBOAT DISASTER on the Mississippi ou Jan. 5 makes the ninth accident of this nature in the past 3 weeks. The *Paris C. Brown* struck a snag near Hermitage, about 160 miles above New Orleans, and became a total wreck in a few minutes. Nine of the passengers and crew were lost. This accident goes still further towards proving our statement of a week ago that travel by rail is much less dangerous than by river navigation.

The Vandevander Bridge.

As the iron bridges of the Pennsylvania Railroad become too weak to carry the extra heavy rolling stock now being placed on the road, the company is replacing all such with stone arch bridges. Although the first outlay is considerably larger than for iron bridges, yet in the end it can be seen where this policy is the wisest.

The majority of these stone bridges are being built on the Middle Division, between Harrisburg and Altoona: two and sometimes three are built every year. One of those built in 1888 is situated about one mile west of Mapleton, Pa., crossing the Juniata river. It was previously a five span iron bridge, 100 ft. spans, built by the Construction Department of the Pennsylvania Railroad in 1864. The old piers are built of sandstone and are 8 ft. wide and 24 ft. high.



Vandevander Bridge; Cross-Section.

For the construction of the stone arches the iron bridge was moved south from its original position to wooden trestles previously built for this purpose. After everything was prepared, the tracks were cut, and by the use of "crabs and falls" the whole iron structure was moved intact, on old rails, from the stone piers to the wooden trestles, a distance of 33 ft. The moving time was 22¼ minutes and from the time the tracks were cut until the first train ran over the bridge in its new position was one hour and ten minutes; part of this time was consumed in replacing a rope broken in the movement.

The stone arches were started from the western end: the excavation for the west abutment was carried down 19 ft. below the surface, in front of the old masonry which was badly cracked: and at that depth, 4 ft. below the bottom of the old masonry, it was considered entirely too dangerous to risk going any deeper for rock, but as it was very hard river gravel, it was decided that, with a bed of concrete the foundation should be started on that.

Pier No. 9 was next started and at 17 ft. below the surface was found limestone rock, dark, fine grained and very brittle, and in this and almost all foundations the rock had almost a perpendicular pitch and from the holes drilled for blasting showed that it was a deep bed of very solid rock. The other piers were easily put on rock, as the ground sloped very quickly towards the river bed, which is itself one bed of solid rock.

The river at this point has a very decided fall and a few miles above the bridge are the mouths of two very large branches of the Juniata river, (the Raystown and the Frankstown) which after a slight rain would raise the river considerably.

On August 22, after a heavy rain the river rose to a flood height and carried away almost all of the false-work and the entire coffer-dam for pier No. 5, which necessitated a delay of about 3 or 4 weeks, in repairing the damage done by the storm, and the construction and sinking of another coffer-dam for this pier: a task which caused a considerable amount of trouble as the river bed was filled with stone from the old coffer-dam and as the current was too strong to allow them to be removed, thereby causing the new dam to leak considerably.

Every other pier, or Nos. 2, 4, 6 and 8, are the old piers cut down to such a height that they could be used for the new arches, although in some cases it was necessary to take off the top courses and replace them with heavier or lighter ones to bring them up to the correct elevation for the springing line.

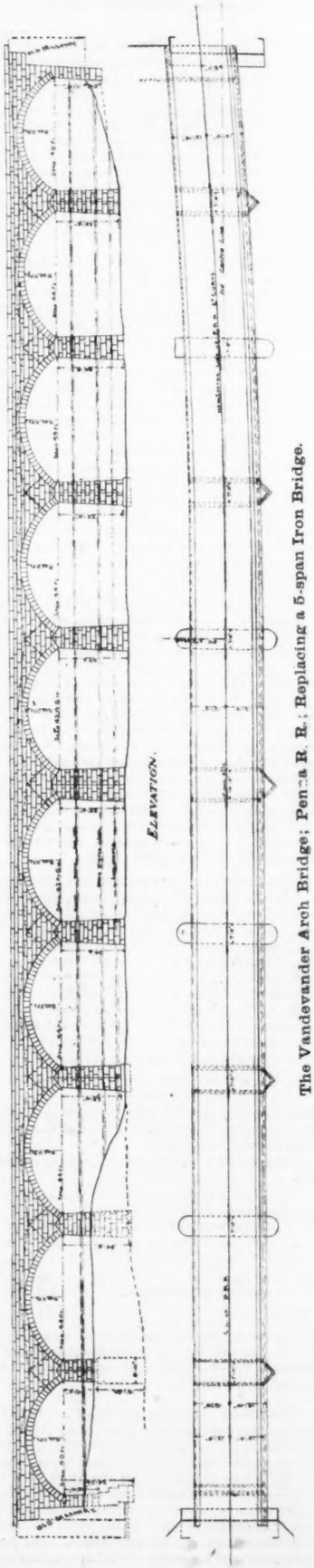
Arch No. 10 was the first arch turned, in a little over three days; the rest followed closely. Arch No. 1 was keyed in 27 working hours, being the shortest time spent on any one arch. Arch No. 10 was keyed on July 21, and the last keystone placed in the series was laid Oct. 20, closing the 10 arches inside of 3 months, 3 weeks of which were occupied in repairing the damage done by the storm.

It will be seen by the plan that arches Nos. 1, 2, 3, and 4 are built upon a curve. It has been the custom of the Pennsylvania Railroad, when a curve came on a series of arches, to build each arch on the chord of the curve and put the curve on the coping only, but in this case it was decided to build everything in connection with the four arches on the curve. The center line at the east end of the bridge makes an intersection of 21°, and to limit the curve to the first four arches, it was necessary to use a compound curve, the branch on the arches being a 2° curve, the P. T. was made to come directly over the center of pier No. 4 and the other two branches of the curve calculated from that.

The work on these four arches necessitated quite a little trouble as every stone laid, including the ring stones, had to be pitched a little. After the centers had been braced in their proper position, lines were run over both faces, by the means of "tangential deflections," marking the curve, and tacks were set showing the upper corner of each ring stone and then every stone was pitched the required amount found by the application of a square to the course below and the back ahead. The whole north side of the bridge was left rough to allow of additions being bonded into the present work, thus saving the cutting of closers, allowing the work to proceed that much faster.

The stone used is from the quarries of Clearfield Co., in this State, and is a mountain sandstone almost pure white in color; the cement is of that brand known as Cumberland cement.

The contractors were Sparks & Evans, of Philadelphia, GEORGE H. BROWN was the Engineer in charge, and the original designs were drawn in the Chief Engineer's office by HENRY RIGHTER.



The Vandevander Arch Bridge; Penna R. R.; Replacing a 5-span Iron Bridge.

THE NEW YORK AND NEW JERSEY BOUNDARY question, which has practically been in dispute since the day of the Duke of York, is now about settled. The north boundary of New Jersey was finally located and settled in 1883, on the old line originally laid down in 1769, but in dispute owing to the disappearance of monuments. The Staten Island line is the one now under settlement by a Commission appointed in 1886 and 1887 by the two States. The valuable land under water in Raritan bay, for the cultivation of oysters, has been the subject of dispute for years, and no attempt was made to define the boundary line until 1834, when the line was said to be "the middle of the bay to the main sea." This vague definition is now to be improved upon, as the increased value of the fisheries demands. The present Commission have decided that the areas of the numerous coves along the two shores must be considered, and after elaborate surveys and infinite trouble have fixed upon a line giving each State an equal area of land under water; which line will be permanently marked by buoys and beacons. The original shore lines, as obtained from old maps and surveys, were used as the basis of adjustment, the many late changes in these lines making them useless in the verification of an old division of territory. The Commissioners for New York for settling the North boundary were HENRY R. PIERSON, CHAUNCEY M. DEPEW and ELIAS W. LEAVENWORTH, with H. W. CLARKE as surveyor; and for New Jersey they were ABRAHAM BROWNING, T. N. MCCARTER and GEORGE H. COOK, with E. A. BOWSER as surveyor. The present commission for the Raritan Bay line is M. W. HAZLETINE, ROBERT MOORE and Lieut. G. C. HANUS, U. S. N., for New York, and GEORGE H. COOK, R. C. BACOT and WILLIAM M OLIVER, for New Jersey

The Completion of the Bridge across the Ohio River at Cincinnati, Ohio.

On Tuesday, Dec. 25 last, the first train passed over the new bridge across the Ohio river at Cincinnati, and the event crowned the completion of a most remarkable record of bridge construction.

The incident of the coupling of the main river span was cited in the columns of this journal a short time ago, but the completion of the entire work now merits a more extended notice.

The entire structure carries a double track railway flanked on each side with a full roadway and sidewalk. The river spans are designed with two trusses, centres 30 ft. apart, with roadways and sidewalks carried on cantilever extensions of the railway floor-beams. The centre, or main channel span is 550 ft. long between centres of piers, while each of the other two river spans (making three in all) are 490 ft. each between pier centres. The iron work of the Covington approach is 1,534 ft. long and consists chiefly of ordinary viaduct work. The Cincinnati approach is 1,747 ft. long, consisting of 927 ft. of viaduct work and 7 pin spans varying from 80 to 200 ft. long. The total length of the iron and steel work is thus 4,811 ft., or nearly one mile. The entire work has been constructed and erected under the designs and specifications of the Phœnix Bridge Co., and of Mr. EPES RANDOLPH, Chief Engineer of the Contracting & Building Company, the owners of the bridge.

Last March the work of construction began in the shops of the bridge company and that of the erection of the Covington approach soon after. In June last as soon as the stage of the water would permit, falsework was begun in the Covington end of the south 490 ft. span. In the early part of August, this span was safely coupled, after a most dangerous flood in the river during the latter part of July. This flood caused a rise in the river of about 25 ft. Large quantities of drift were brought down by the current and lodged against the falsework, then carrying the large traveler and about two-thirds of the trusses and railway floor. The pressure of this mass was so great that it pushed the falsework about one foot down stream, but did no other damage. About the middle of August the first of the iron and steel of the 550 ft. span was run out on the falsework, and shortly after the Ohio river experienced another flood rise of about 27 ft. with enormous quantities of drift. On August 26, when the falsework for this span was nearly complete and carrying about 700,000 lbs. of iron and steel railway floor and eye-bars, the drift formed a continuous mass for over 500 ft. up stream from the bridge and in spite of extensive though temporary protection, swept falsework, two travelers and iron and steel work down the river in an absolutely complete wreck. Masses of this wreckage were stranded down the river from the bridge site for 45 miles, and two steel eye-bars were picked up at the latter point.

Although the river receded only from 5 to 17 ft. during the ensuing four weeks, the bridge company immediately ordered new lumber for falsework and travelers, and piles from various points in Ohio, Indiana and Georgia, so as to concentrate the largest quantity in the shortest time. It also ordered new hoisting apparatus, and founded and started within four days after the wreck an extensive electric light plant, which so thoroughly illuminated the entire bridge site, that all the operations of pile driving, placing falsework, and erection of the iron and steel work were actively and continuously prosecuted both day and night. In fact from the date of the wreck to the completion of the structure on Dec. 25, there was no cessation of operations either night or day. So actively was the work prosecuted that just five weeks from the date of the wreck the entire falsework including piles, the two travelers, and about 1,200 lin. ft. of pile protection were completely in place, with the iron and steel floor once again being placed on the falsework. During this time over 950 piles had been driven and nearly a million feet of lumber framed and placed in the falsework and two travelers; the traveler for the handling of the iron and steel being the largest ever constructed. The 700,000 lbs. of iron and steel railway floor had within the same time also been entirely reconstructed at the Phœnixville shops from new material and delivered at Cincinnati. During the ensuing four weeks, the erection of the iron and steel work for the 550 ft. span was pushed forward night and day. On Oct. 28, just nine weeks after the destruction of the falsework by the high water, this entire span complete with trusses, railway floor, upper and lower lateral systems and all tranverse bracing, was safely coupled by the driving of the last upper chord end pin at the north end of the span, and was swung clear from the falsework 36 hours afterwards. The coupling of this span was completed just after a heavy storm, with a flood rise of about 27 ft. making the third period of high water since the beginning of the work. The water in the river continued at or near this high water mark for some three weeks and prevented the driving of any piles for that length of time in the north 490 ft. span. During the last part of November, however, the water commenced to recede and the remaining pile driving and falsework was soon completed. On Dec. 9, the first iron work for the railway floor was run out on the falsework of the north 490 ft. span and the erection of the remaining iron and steel work was carried on continuously day and night until the last coupling was effected, as stated, on Dec. 25. The placing and erection of all iron and steel work of this span was therefore completed in 16 working days.

In the meantime the Cincinnati approach had also been pushed forward night and day under electric illumination, by a separate erecting force sufficiently large to complete it simultaneously with the coupling of the last river span. In a little over 9 months therefore from the beginning of work in the shop, this entire structure nearly a mile in length, embracing all the iron and steel work and timber floor, including in round numbers about 10,000 tons of iron and steel, was completed and carried traffic. It is believed that this record in bridge construction has never yet been equalled, either in this country or in Europe. The 550 ft. channel span is the longest and heaviest truss span of its kind ever constructed. The trusses are 84 ft. deep between centres of chords at the center of the span, and the high traveler required for its erection is the largest ever used for such a purpose. It was fitted with 4 hoisting engines and handled simultaneously a number of pieces, each weighing over 30,000 lbs.

The magnitude of this work and the celerity with which it has been accomplished, over a river constantly subject to great floods and enormous movements of drift, and in a season when they have been more frequent than in 25 years before, makes it a remarkable piece of construction and reflects the highest degree of credit not only on American engineers, but especially on the engineering firm which has accomplished it.

General Statistics on the Life of Rails.

The *Verein deutscher Eisenbahn-Verwaltunger* (Society of German railway administrations) which has done much for science by the compilation of many valuable statistics, has recently published its "Statistics on the life of rails upon the main tracks of railways", extending over a period of 6 years, viz., 1879 to 1884. Considering that the period of observation has been comparatively short, and that the amount of wear upon the rails has, in many cases, been so trifling as to render exact measurement difficult and not entirely free from doubt, the statistician of the society has, for the present, refrained from drawing any conclusions from the voluminous material presented in his report.

The volume contains the results of observations from 38 different railways in Germany, Austria, Hungary, the Netherlands and Belgium. The trials were made on the following kinds of track.

A. Steel rails, (*a*) on single track roads.
(*b*) on double track roads.
B. Iron rails with head of steel.
C. Rails of different materials on uniform track, for example; Bessemer steel, Martin steel, fine-grained iron, puddled steel.

Under fifty different conditions, exact information is given about position, length and design of the trial track, radii of curves, gradients, place of manufacture, dimensions of cross-section of rails, weight, moments of inertia, moment of resistance, made fastening, working stress, wear, etc. We give below some of the results obtained, retaining the expressed metric values.

The wear of steel rails, expressed in lineal millimetres of their height, for a single track road and the rails being laid on cross-ties, was found to be as follows, for every million of "tonnes" (2,204 lbs.) of load run over the trial rail:

		mm.
1.	Track level and gradients not exceeding 0.3 p. c.:	
	a. from tangent to curves of 1,000 m radius:	0.04
	b. from curves of 1,000 m to 400 m radius:	0.07
	c. from curves of 400 m to 300 m radius:	0.10
2.	For gradients of 0.300 to 0.75 per cent.	
	from tangent to curves of 1,000 m radius:	0.17
	the same for double track ascending grade:	0.08
	" " descending grade:	0.11
3.	For gradients of 0.75 to 1 per cent. and curves of from 1,000 m to 600 m radius:	0.21
4.	For gradients of 1.5 to 2 per cent. and curves of from 300 m to 200 m radius:	0.22
5.	For gradients of 2 to 2.5 per cent.	
	a. and curves of from 1,000 m to 600 m radius:	0.31
	b. " " " from 300 m to 200 m radius:	0.51
	c. " " " less than 200 m radius:	0.96

According to HEUSINGER's hand-book, for railways with moderate gradients (0.5 to 0.6) and curves of large radii, with little or no application of brakes, the rolling load having a wearing-off effect of one vertical millimeter upon the head of a steel rail will vary from 10 to 20 million tons. Upon heavier grades, where brakes come into use, the said load will naturally be much less.

Another authority, Chief Engineer RUEPPEL, of Cologne, finds the average life of Bessemer steel rails for a daily traffic of 23 trains, to be 30 years.

A result which is somewhat more favorable, is obtained from the statistics just published, viz., 35 years, if we may admit the assumption that the rail shall be considered unfit for further use on the main track, after 12mm. (15-32 ins.) vertically shall have been worn off, by comparing the life of a rail traveled over on an average, by a load of 3,430,000 tons annually, taking its wear from the above table to be 0.07mm. with that of a rail wearing down 0.17mm. The former case gives a life of 50 years for the rail, the latter 20 years, hence average life, 35 years. The 3,430,000 tons of annual rolling load will about represent in Germany, the traffic of a road running 28 passenger trains and 10 freight trains daily.

With the aid of the statistical tables referred to, the proper life of a standard rail may be calculated for each separate section of roadway, by picking out that one of the 50 different conditions given in the table, which comes nearest the case in question. We fear, however, these statistics must be taken with many grains of salt; it being quite certain, for example, that the heavy increase of wear on grades is not due to the grades *per se*, but to the greater proportion of engine tonnage as compared with car-tonnage on heavy grades. Again it is not likely that any of these rails will last as long as the observations indicate. The surface will become too uneven.

LA LOUVIERE HYDRAULIC CANAL LIFT. — The largest hydraulic canal lift in the world, of which two illustrations have been given recently by *The Engineer*, has been completed during the past summer. It was constructed for the Belgian Government by the Société Cockerill, of Seraing, from the designs of, and under the superintendence of, Messrs. Clark, Standfield & Clark, of Westminster, the consulting engineers of the Government and the patentees of the system. The difference between the levels of the upper and lower canals, that is, the height the boats are raised, is 50 ft. 6¼ in. The lift consists of two pontoons or troughs, each 141 ft. long by 19 ft. broad, with 8 ft. draught of water, and are capable of holding the largest size of barge that navigates on the Belgian broad gauge canal system; such barges are capable of taking 400 tons of coal or other cargo, so that the total weight of the trough, water, and barge is not much under 1,000 tons. This immense weight is supported on the top of a single colossal hydraulic ram of 6 ft. 6⅝ ins. diameter and 63 ft. 9½ ins. long, working in a press of cast iron, hooped continuously for greater security with weldless steel coils. The working pressure in this press is about 470 lbs. per square in. The time actually occupied in the operation of lifting or lowering is only two and a-half minutes.

THE gross value of all minerals mined in the United States is estimated by the Geological Survey at $538,000,000, being the greatest ever produced, and $70,000,000 ahead of last year, which was slightly below some previous records.

The Dimensions of Pipe Flanges and Cast-Iron Pipes.*

The object of the present paper and diagram is to bring before the members of the Club the subject of *diameters of flanges, diameter of bolt circle, size and number of bolts and thickness of cast-iron pipe.*

It is proposed by means of the diagram to give graphically a standard for adoption, arranged in such manner as to be easily understood and readily applied.

All mechanics know that the flanges used in different foundries, on the same diameter of pipe, are not of the same outside diameter, do not contain the same number of bolts, nor bolts of the same size. This creates confusion, especially in repair work in large establishments, where, perhaps, a portion of the work is furnished by different contractors. It often occurs that a valve or a piece of pipe requires changing from one place to another. Upon examination it is found that although the inside diameter of pipe or valve may be the same, yet there is a difference of from ½ in. to 1 in. in the outside diameter of flanges; one may have 1 in. bolts and the other only ⅞, one may have four in number and the other six, and a corresponding difference in the diameter of bolt circles. Just why this difference should occur I am at a loss to explain, other than from a difference of opinion on the subject. It seems possible to make good steam and water tight joints in cast-iron pipe of a standard size, and have them so proportioned that a corresponding relation will be maintained between the different sizes.

A very common trouble is the inclination to put too few bolts in a flange to hold the joint for any length of time under pressure, and another to place bolts of a small size on a bolt circle of large diameter.

Several tables are published giving diameters of flanges and numbers and sizes of bolts, in which a ⅝-in. bolt is given as a suitable size for a 48-in. pipe under a pressure of 100 lbs. per sq. in. In practice, and especially after pipe has been exposed and oxidation has proceeded to a greater or less extent upon the nuts and heads of bolts, it will be found difficult to keep the joint tight if success be attained in making it so in the first place.

From practical experience as well as from observation, joints in a 48-in. pipe, made with bolts 1¼ in. diameter on a bolt circle of 55 in. diameter and spaced at a distance of nearly 4.3 ins. from center to center, have been found to give satisfactory results in every case, and no trouble has been experienced, either in making the joint, or keeping it tight thereafter. In making a computation for strength of the joint with bolts of this size, based upon the net section of bolts compared with the strength of flange, it will be found that a large margin of strength in excess of the flange is found in the bolts; the same result is reached in the 36-in. pipe, using 1⅛-in. bolts on a bolt circle 42 ins. diameter, and bolts spaced about the same distance apart as in the 48-in. pipe; also for the 30-in. 20-in. 16 in. and 12-in. All these sizes have been under practical observation for several years and have been in use upon water pipe with excellent results.

The excess of strength in bolts, it seems, must be utilized in the strain put upon them to make the joint. This strain, of course, is uncertain, and no doubt at times with small bolts exceeds the limits of elasticity of the material. With one bolt strained beyond the elastic limit, the work thrown upon the adjoining ones is considerably increased and at every change of function, there will be described a curve for which the following equation can be made: $c = 7 + \frac{98}{D}$ in which c equals a co-efficient found by dividing the practical thickness t by the theoretical thickness t', or $\frac{t}{t'} = c$: D = diameter in inches.

In the equation, the quantity 7 is a constant and is made parallel to the line of diameter; it is also an asymptote to the remaining portion of the equation which is affected by the variable D, and which forms the equilateral hyperbola. The portion of the diagram shaded by cross-lines between the asymptotes and the curve is designated as the co-efficient for handling, while the portion between the asymptotes and the line of diameters has been designated as the co-efficient for safety. It is to be remembered that these two co-efficients are so designated for convenience as parts of the equation, and the sum of both form the co-efficient c.

The diagram is drawn to show graphically the thickness for tensile strength = 15,000 lbs., and pressure = 100; to show graphically the thickness for tensile strength = 18,000 or 20,000 lbs. The scale can be made 1.2 and 1.33 larger. Scales for 15, 18 and 20 are given in the margin of the diagram.

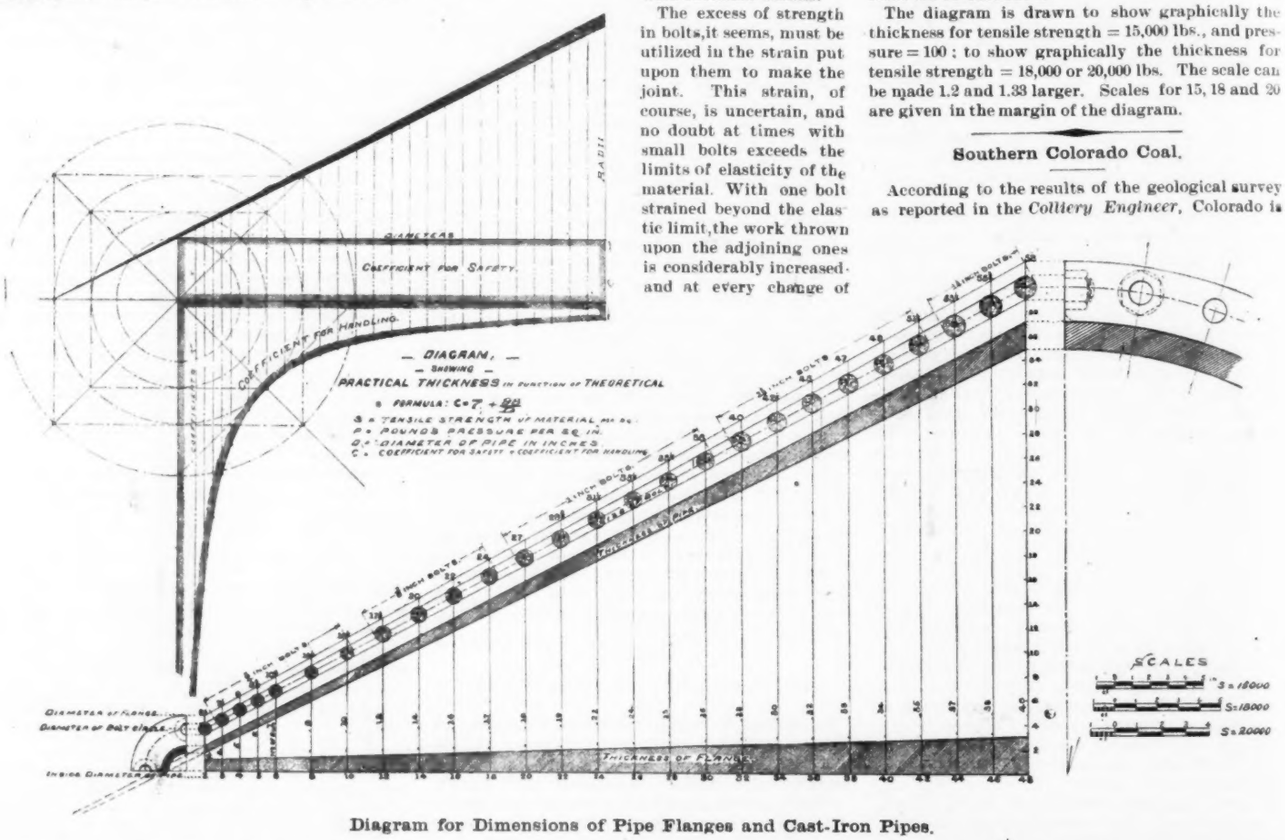

— DIAGRAM, —
— SHOWING —
PRACTICAL THICKNESS IN FUNCTION OF THEORETICAL
FORMULA: C = 7 + 98/D
S = TENSILE STRENGTH OF MATERIAL
P = POUNDS PRESSURE PER SQ. IN.
D = DIAMETER OF PIPE IN INCHES
C = COEFFICIENT FOR SAFETY + COEFFICIENT FOR HANDLING
COEFFICIENT FOR SAFETY.
COEFFICIENT FOR HANDLING.
DIAMETER OF FLANGE.
DIAMETER OF BOLT CIRCLE.
INSIDE DIAMETER OF PIPE.
THICKNESS OF FLANGE.
SCALES
S = 15000
S = 18000
S = 20000

Diagram for Dimensions of Pipe Flanges and Cast-Iron Pipes.

From observation and experience the most common cause of leaky joints can be directly traced to either small bolts, or too few of them, or both combined. The late JOSEPH HARRISON, Jr., said to the writer that "he did not wish bolts used in the proposed traction engine he was constructing," just before his death, "less than 1-in. in diameter."

The thickness of pipe by the diagram has been taken from pipe in practical use, and from tables and comparison made and collected of cast iron pipe under pressure in various cities and foundries in the United States.

In the diagram before us the pressure has been taken at 100 lbs. per sq. in.; strength of the cast iron at 15,000 per sq. in.

The principal object of the diagram of thickness is to show graphically some points that appear from it, which perhaps have not been brought out before in the same form, at least not to the knowledge of the writer.

It is to be observed that the practical thickness from zero diameter to 48-in. diameter, when expressed in function of theoretical thickness and plotted to scale upon a diagram in which the abscissæ, shall be the diameters, and the ordinate shall represent the

*By J. E. CODMAN, in Proceedings of the Engineers Club of Philadelphia.

Southern Colorado Coal.

According to the results of the geological survey as reported in the *Colliery Engineer*, Colorado is destined to be the Penusylvania of the West. Within 60 miles of Pueblo there are 1,000,000 acres of coal lands, with veins now being worked from 6 to 9 ft. in measurement. The coal output in Colorado for 1887 was 1,791,735 tons, of which 1,055,676 tons were produced in three counties adjacent to Pueblo on the west and south. The amount of coal in the Canon district is estimated at 150,000,000 tons, all about the best bituminous coal known. The retail price in Pueblo of bituminous coal for domestic purposes ranges from $3.50 to $5 per ton. The average value of the coal on the cars at the mines is $3.25 per ton. The average number of persons employed in and around the mines during the year is estimated at 8,000. The average price paid to miners for digging and loading the coal and timbering their working places is 86⅓ cts. per ton of 2,000 lbs. of screened coal on the cars at the mines, including royalty, is $1.73 per ton.

——THE HARRINGTON PATENT SEMAPHORE SIGNAL is to be adopted on the South and North division of the Louisville & Nashville. The system is now in use on other divisions of the road. The signal consists of two movable arms, attached to a tall pole. As a train approaches the pole the arm on the right indicates whether or not a halt must be made. If the arm is horizontal it means danger, and the train must wait for further orders If lowered the track is clear and no stop is made.

Naval Progress in 1889.

From the report of the Secretary of the Navy, it appears that the following is the list of armored and unarmored vessels of the new navy :

Unarmored vessels (20 in all, 12 building, excluding torpedo boat.)

Name.	Condition	Guns.	Tonnage.	Horse Power or speed.
Dolphin	In com'n	1 6-in. rifle	1,485	2,240
Boston	In com'n	2 8-in. rifle		
		6 6-in. rifle	3,189	3,780
Atlanta	In com'n	2 8-in. rifle		
		6 6-in. rifle	3,189	3,350
Chicago	In com'n	4 8-in. rifle		
		8 6 in. rifle		
		2 5-in. rifle	4,500	5,084
Charleston	Launched	2 8-in. rifle		
		6 6-in. rifle	3,730	7,000
Baltimore	Launched	4 8-in. B. L. R.		
		6 6-in. B. L. R.	4,413	9,000
Yorktown	Launched	6 6-in. B. L. R.	1,700	3,000
Petrel	Launched	4 6-in. B. L. R.	890	1,100
Newark	Building	12 6-in. B. L. R.	4,083	8,500
Philadelphia	Building	12 6-in. B. L. R.	4,324	19 knots
San Francisco	Building	12 6-in. B. L. R.	4,083	19 knots
Concord	Building	6 6-in. B. L. R.	1,700	3,400
Bennington	Building	6 6-in. B. L. R.	1,700	3,400
Vesuvius	Launched	3 15-in. dynamite guns	725	20 knots
First-class torpedo boat	Building	8 automobile torpedoes	99	23 knots
Cruiser No. 6	.....	.....	5,300	20 knots
Cruisers No. 7 and No. 8	.....	.....	3,000	19 knots
Cruisers No. 9 and 10	.....	.....	2,000	Speed not fixed
Practice vessel	.....	.....	800	.....

In the list of armored vessels for the new navy we have the following ; all as yet unbuilt, except the 5 old monitors, *Puritan* to *Monadnock*, which are to be reconstructed :

ARMORED VESSELS.

Name.	Condition.	Guns.	H. P.	Tonnage
Maine	Building	Four-10-inch B. L. R. Six 6-inch B. L. R.	9,000	6,648
Texas	"	Two 12-inch B. L. R. Six 6-inch B. L. R.	8,000	6,300
Coast defense	Plans ready	One 16-inch 115 ton B. L. R. One 12-inch 48-ton B. L. R. One 15-inch dynamite gun	5,400	4,000
Puritan	Completed in hull	Four 10-inch B. L. R.	3,058	6,060
Terror	"	"	888	3,815
Miantonomoh	"	"	1,630	3,815
Amphitrite	"	"	1,000	3,815
Monadnock	"	"	3,000	3,815
Armored cruiser	Not com'nced	.....	.....	7,500

The navy at the beginning of the year consisted of 8 vessels of 2,100 to 3,900 tons, 20 third-rates of 1,020 to 1,900 tons (all these 28 vessels being in commission); 18 old monitors 1,875 to 6,000 tons, and 5 small unarmored cruisers in commission ; besides a large and varied assortment of hulks unfit for any kind of service.

To compare the vessels of the new navy, as given above, with those of other countries, it may be interesting to know that of the 10 knot war ships of 3,000 tons and upward Great Britain has 10, the United States 8, France 5, Spain 3, Japan 2, and Russia 1. In this summary the position of the United States is second, and, considering the short growth of the new navy, the above standard is very high.

The importance of unarmored cruisers and high speed can be judged from the remarks of Secretary WHITNEY in his last annual report.

"The importance which has been placed upon this branch of naval armament will be appreciated from the statement that England and France possess 65 vessels of the class known as unarmored cruisers. * * * We cannot at present protect our coast, but we can return blow for blow, for we shall soon be in a condition to launch a fleet of large and fast cruisers against the commerce of an enemy, able to inflict the most serious and lasting injury thereon. The one characteristic which an unarmored cruiser must possess is great speed. She must be able to escape from ironclads and outrun, so as to overhaul, merchantmen. If slower than ironclads she could not keep the sea, and if slower than merchantmen she might as well stay in port."

During the past year, the fastest, largest, and most powerful protected cruisers yet laid down are the *Blake* and *Blenheim* of the English service. The displacement of these vessels is 9,000 tons each; the indicated horse-power 20,000, trial speed 22 knots, with a continuous sea speed of 20 knots. These vessels have heavy protecting decks, ranging from 4 to 6 ins. in maximum thickness. The *Piemonte* of the Italian navy is the fastest cruiser built during the year just past Sir William Armstrong & Co. were the builders, and she was bought from them by the Italians. Her displacement is about 2,500 tons, and it is expected, with her 12,000 H. P. that she will develop a speed of 21½ knots.

Of the new vessels for the American navy which have been under trial, none have developed such remarkable speed as the dynamite cruiser *Vesuvius*, now undergoing a series of trials before a board of United States naval officers. The *Vesuvius* has developed a rate of speed equivalent to 21.47 knots per hour, and with the terribly destructive powers possessed by her three 17-in. dynamite guns she will be one of the most formidable vessels in the navy.

The introduction of dynamite guns into the naval service was not without considerable opposition on the part of many navy officers, the prejudice against the use of dynamite in warfare being openly avowed. This prejudice has for the most part been overcome, and many officers have learned to look favorably on this dynamite cruiser, which it is fondly hoped will create as much wonder in the naval world as did the *Monitor* and her appearance in 1862.

The guns now in course of construction for the new vessels are the designs of an ordnance board composed of navy officers. These guns have attained remarkable success, and the velocity obtained compares favorably with the best results of those of Armstrong's and Krupp's build. The principal developments during the year in the department of ordnance have been in improved powder and projectiles. The greatest improvement in the manufacture of gunpowder has been made in France and Germany, whereby, in the case of the former, initial velocities of 2,400 and 2,600 ft.-seconds have been obtained. In the case of our new 6-in breech-loading rifles, a projectile could be driven through 15½ ins. of iron if propelled by this description of powder. As it is, a projectile from the 6-in. breech-loading rifle, when propelled by the regulation American powder, pierces 12 ins. of iron. Experiments are in process to obtain a higher grade of powder.

The Abt Rack-Rail System in New Zealand.

The Abt system of rack-railways, which has been described in detail in ENGINEERING NEWS, is likely to be adopted in New Zealand, for the purpose of avoiding a long and expensive tunnel, and enabling the route of which it will be a part, to be opened much sooner than if the tunnel had to be made. The following is an extract from a recent speech of the President of the New Zealand Midland Ry. Co. at a meeting of the stockholders in London.

"Clause 4 [of the contract with the New Zealand Government] is an important one, and contains power to substitute an incline for a tunnel. On the route between the east and west of the middle island of New Zealand, it was contemplated that there should be a tunnel, which would have been one of some considerable difficulty and importance, and the engineering difficulties were such as to cause anxiety. I have had many discussions with our engineer upon the subject, and we have for some time come to the conclusion that on all accounts it would be wise to avoid the making of the tunnel if possible. The main reason that affected my mind was that the making of the tunnel will save a very great deal of time, certainly some years, in making the route between the east and west of the island, which we were of course anxious to complete as rapidly as possible ; and I saw at once the importance that saving of time was, not only to ourselves but also to New Zealand. I confess I made less of the engineering difficulties ; because I always expect an engineer to do exactly what he is asked to do. But this other reason certainly weighed very much with me, and last winter our engineer went with me to Germany in order to see a railway which is carried over certain inclines in the Hartz mountains, under a system called the Abt system. We examined it carefully, and came back very well satisfied with it. The Agent-General has also visited this railway with the same view. I think we are all of opinion that the Abt system will be eminently suitable for our particular wants, and will relieve us from the great difficulty and risk of making this long tunnel. There is not only the advantage of time in avoiding the making of the tunnel, but there is also a very substantial saving of expense. It is difficult to quote exact figures, but the saving is very great, and we have practically come to an agreement that this incline system may be adopted and substituted for the tunnel if we can satisfy the New Zealand Government that the convenience and cost of working is as advantageous both to the company and to the public as the other system, and this we believe we can do. The cost of this railway was taken, for purposes of calculation at $12,500,000. If, by substituting the incline system for the tunnel system, we reduce the whole cost of the railway below that specified sum, then we should take in proportion so much less land from the Government."

Two Governors on the Road Question.

The following abstracts from the late messages of Governors BEAVER and AMES are encouraging, as calling the attention of the legislative bodies, who must first act in any project for permanent improvement, to the crying need for such enactment and the gain therefrom. Governor BEAVER of Pennsylvania, says :—

"It is said that the civilization of a country is marked by its roads. If this be true, Pennsylvania cannot claim to have ranked highest in civilization. It is safe to say that no expenditure of public moneys yields so little in return as the road taxes of Pennsylvania. Our entire system of road laws—or rather our road laws which lack system—should be thoroughly revised and codified. They served their purpose when temporary roads were to be laid out and cheaply made through unbroken forests and over lands which had but little value. The time has come when it will be economy, in every way, to build our roads permanently and substantially. The comfort of our people, economy in the transportation of our products, saving in the wear and tear of vehicles and animals, and the needless multiplication of highways, all demand that the laws governing the laying out and construction of our roads should be radically reformed and systematized.

This may be considered a matter of minor importance and yet it affects every inhabitant of the commonwealth We must all use, at some time or other, in some way or other, our public roads. Their character and condition affect the breeding of our stock, the style of our vehicles the carrying capacity of the farmer's wagon, and the speed and enjoyment of all who travel them for business or pleasure, either in the carriage, in the saddle, on the bicycle, or on foot. A thorough system should be devised and authorized by the Legislature which could be put into immediate effect by our older communities, and adopted by those which are newer, as their ability and the wants of their people might require.

Gov. AMES of Massachusetts has taken up the same subject in his last message. He says :

"The knowledge and skill required to construct and maintain good roads and bridges in the most economic manner requires long experience combined with good judgment and a special knowledge of relative value of available materials. I therefore recommend the passage of a law authorizing the appointment of some suitable and skillful person who shall have a general advisory oversight of the roads and bridges of the cities, towns, and counties of the commonwealth, who may be freely consulted by the local authorities without charge, and who shall make an annual report to the Legislature relative to the roads and bridges in the commonwealth, with such suggestions as from time to time shall tend to promote the public interest."

Weights and Measures in Japan.

Kan = 1,000 momme = 8¼ lbs. avoirdupois.
Shaku = 1 ft.
Ken = 6 shaku = 6 ft.
Chô = 60 ken = one-fifteenth mile.
Ri = 36 chô = 2.44 miles.
Chô, land measure, = 2½ acres.

The metric system of weights and measures is growing into favor, and it is stated to be the intention of the Government to introduce it into Japan at an early period.—*U. S. Consular Report.*

THE following requisition is given by a Buffalo paper as "an exact copy" of a message handed an operator on one of the Eastern trunk lines a few days since addressed to the division roadmaster :

To ———Roadmaster———, N. Y.

send me a man i hav no man i discharged my man i kneed a man send me a good man and four pick handles

afexionatly your umble servent

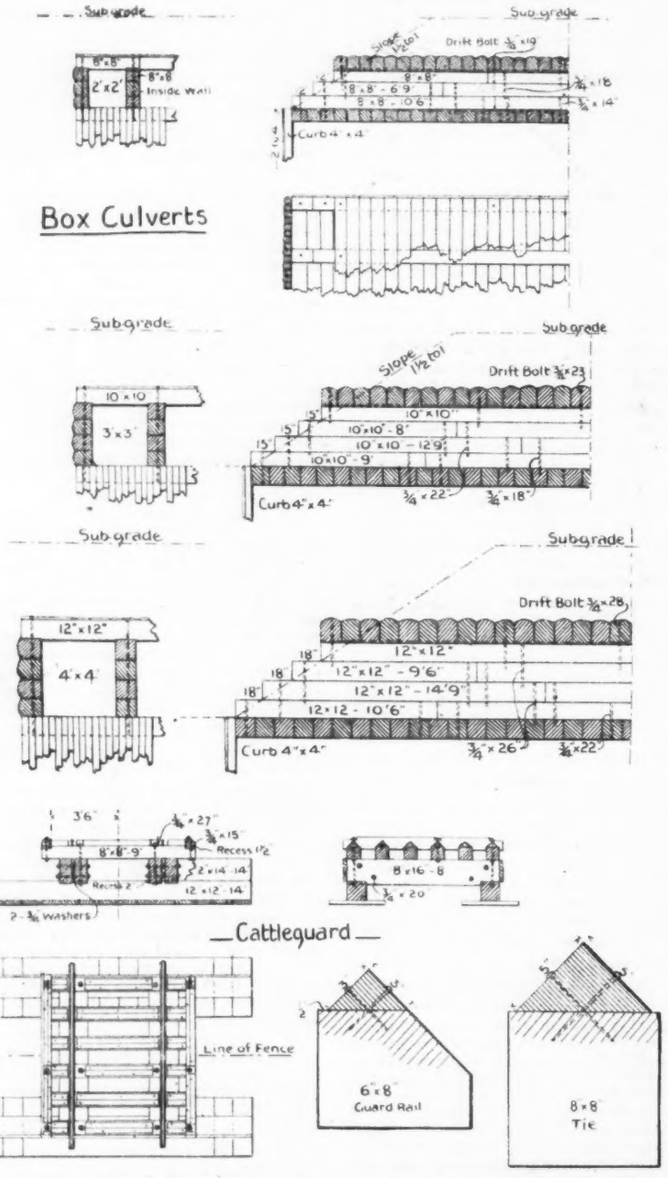
jery McNuity and a frog.

——A MEETING OF RAILWAY COMMISSIONERS from all the States having such officers has been proposed by the Inter-State Commerce Commission for purposes of conference and to consider the relations of the law to the railways, and will probably be held soon after March 4.

Standard Wooden Box Culverts and Cattle-Guards.

The accompanying drawings show standards of two details as to which there is a great variety of practice. Many do not like the form of cattle-guard shown, which consists simply of a grill, resting on stringers which rest on a cross-sill, which in turn rests on mud-sills, reliance being had on the triangular slats to act as guards rather than on the depth of the pit. Opposite opinions are (1) that a deep entirely open pit is best, and (2) that an iron slat arrangement on which cattle cannot walk, making no other difference whatever in the track and road bed, is the best. Both form of guards do good service, as we presume this form will also. When the slats are too close together, cattle sometimes attempt to walk in them.

The wooden box culverts are shown with broken covers to indicate that they are if necessary made double. The sheet piling at the end is of indefinite length. Wooden box culverts were for many years regarded as bad practice, but the absolute impossibility of getting stone on thousands of miles west of the Alleghenies, and the many disadvantages of open culverts, wood or stone, has gradually established the fact that wooden box culverts do very well for many years; that the soil so packs above them that it will not cave in even if the wood becomes entirely rotten, so long as there is enough of it left to protect the earth surface from exposure to the air; and that when it becomes necessary to renew them, the more or less rotten wood may be scooped away without danger of caves for a long enough time to make it easy to draw through iron pipes of equal clear section. Hence, this has now become accepted good practice when stone cannot be had within a reasonable haul, and instead of using covered culverts only when necessary, open culverts are now used only when necessary, in the best practice.



Standard Wooden Box Culverts and Cattle-Guards, Oregon Pacific Railway.

THE question is being agitated even in England of having the census taken every 5 years instead of every 10 years, with no little probability of the suggestion being adopted. Yet in this country, which grows and changes so rapidly that the census becomes antiquated almost before it is published, it has proven as yet impossible to get an extra $5,000,000 appropriated from our overflowing treasury to have the quinquennial census adopted.

——THE ANTOFAGASTA (CHILI) & BOLIVIA RAILWAY CO., has been incorporated in London with a capital stock of $7,250,000, to build railways, street railways, etc., in Chili and Bolivia. Agreements have been entered into with the Compania Huanchaca de Bolivia.

Hyde Park Water-Works Tunnel and Inlet Crib.

BY C. MCLENNAN, C. E.

At the solicitation of many friends I have consented to give a concise detail account of my experience in the construction of the submarine inlet crib to the Hyde Park water-works tunnel under Lake Michigan at the foot of 68th St., in hopes that it may prove of use to those conducting such work in the future.

During the summer of 1884, while discharging the duties of Civil Engineer and Superintendent of Public Works for the village of Hyde Park, the tunnel which had been in process of construction for some time under the supervision of different engineers was nearing completion. Then the trustees of the corporation began to take into consideration the construction of an inlet crib.

The plan proposed by Gen. Sooysmith & Son, engineers, of New York, for a submarine crib were finally adopted, and the contract for the construction thereof and for its connection with the tunnel was let to Hean & Corbyn, contractors, for the sum of $24,000.

The village authorities, by the advice of the Consulting Engineers, Gen. Sooysmith & Son, thought it advisable that I should personally take charge of the work as Resident Engineer. I accordingly did so, and as a preliminary, measured carefully the length and angles of the tunnel, laid out and measured carefully a base line on the lake shore and connected this base line with the tunnel alignment, taking precaution to avoid error. At each end of this base line I had constructed a temporary but solidly built rough structure on a good foundation upon which a transit instrument would firmly set, and by this I gave the contractors a point in the lake on the line of prolongation of the tunnel (which still continued to advance at the rate of about 15 ft. per day) and at the desired distance from the shore.

They now started operations by driving 4 piles and constructing a scaffold thereon from which to make a boring to ascertain the nature of the soil, choosing the point given for the center of the crib as the boring point. Leaving the pipe used for that purpose to designate it, the boring having proved satisfactory, a square templet of gas pipe 16 ft. on a side was lowered into position (having the boring in the center thereof) to mark the bounds of the excavation, which it was necessary to make to the depth of 11 ft. below the bottom of the lake in order to receive the wooden inlet crib, then being constructed in the South Chicago harbor in accordance with the plans submitted herewith.

In order to facilitate the operation, a small clam shell dredge holding about ⅛ of a cubic yard was constructed and placed upon the front of a scow and operated by a small hoisting engine. One end of the scow was held by a heavy anchor and the other swung into proper position and fastened over the point of excavation. The work of removing the top surface of sand overlying the hard pan on the bottom of the lake to the depth of 6 or 8 ins. having been completed, the diver bored 5 or 6 augur holes at a time, into each of which a dynamite cartridge 1¼ x 5 ins. was inserted and discharged by an electric battery, the earth thus loosened after each discharge, being hoisted on to the scow for removal to some distance; this was continued till the proper depth was attained. The operation was very slow, requiring several weeks for its completion. The crib provided with a false bottom and ballasted with sand was now towed out of the harbor, placed in position and lowered into this excavation by loading therein additional sand. After leveling the crib, a concrete of Portland cement, some in bags and some loose was lowered and packed in around the exterior sides filling the excavation to the height of 6 ft. from the bottom of the crib, the balance of the excavation to the bottom of the lake being filled with clay and tamped.

An iron cylindrical shaft 3 ft. 10 ins. in diameter and of sufficient length to reach above the surface of the water some 22 ft. was now attached to the cast-iron cap bolted on to the top of the crib for the purpose; and upon the top of it a shaft 10 ft. in length, of the same diameter, constructed with doors so that it could be used for an air lock if necessary, was bolted; this shaft was now guyed with 5⅛-in. anchor

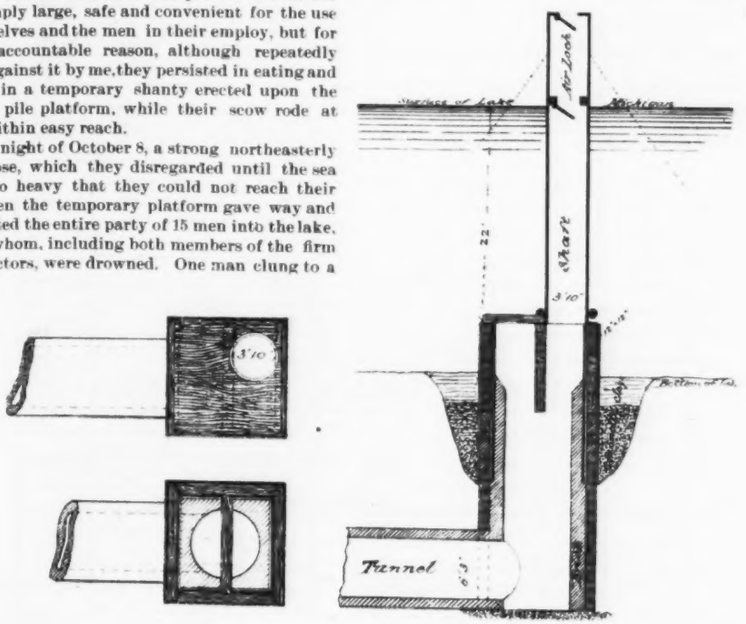
chains to the foot of piles driven in the proper position for each chain and about 60 ft. from the center of the shaft. A small hoisting engine was placed on a platform erected for the purpose by driving two additional piles contiguous to those already driven and convenient to the shaft, great care being taken to drive no piles in close proximity to the crib or tunnel beneath. But at this juncture a most serious accident occurred: The contractors had provided themselves with a covered scow in addition to the one used for the prosecution of the work, amply large, safe and convenient for the use of themselves and the men in their employ, but for some unaccountable reason, although repeatedly warned against it by me, they persisted in eating and sleeping in a temporary shanty erected upon the aforesaid pile platform, while their scow rode at anchor within easy reach.

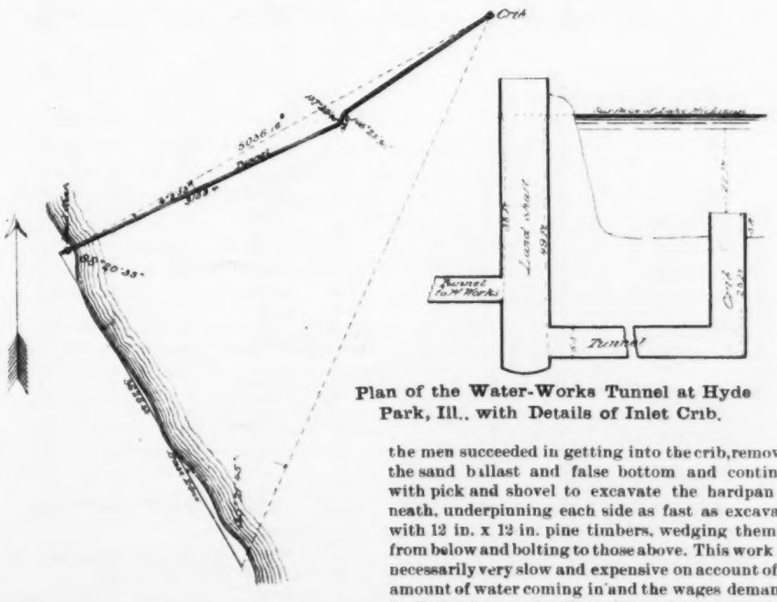
On the night of October 8, a strong northeasterly storm arose, which they disregarded until the sea became so heavy that they could not reach their scow, when the temporary platform gave way and precipitated the entire party of 15 men into the lake, eight of whom, including both members of the firm of contractors, were drowned. One man clung to a plank for several hours until driven ashore some 3 miles distant, and the remaining men were able to regain a position upon one of the timbers suspended between two piles until rescued the following afternoon by a crew from the Government life station at Chicago.

After the storm passed and sea subsided, I found on examination that with the exception of one or two broken guys that the shaft had weathered the storm safely. As no person was likely to come forward and finish the work on the part of the deceased contractors, the Village Trustees concluded to have me take entire charge of the work and prosecute it to completion as expeditiously as possible. To that end I employed an expert foreman in the person of Mr. MINOR, of the firm of Robinson & Minor, tunnel contractors who had shown push and energy in their part of the work.

I also engaged a tugboat to remain in constant attendance and proceeded to erect a substantial platform over the shaft at the height of 13 ft. above the surface of the water on piles driven in selected positions clear of the crib and tunnel which were properly guyed; and from this platform, with scows and tug alongside, we conducted the work.

After more or less trouble in overcoming leaks,





Plan of the Water-Works Tunnel at Hyde Park, Ill., with Details of Inlet Crib.

the men succeeded in getting into the crib, removing the sand ballast and false bottom and continued with pick and shovel to excavate the hardpan beneath, underpinning each side as fast as excavated with 12 in. x 12 in. pine timbers, wedging them up from below and bolting to those above. This work was necessarily very slow and expensive on account of the amount of water coming in and the wages demanded by the workmen, viz., $1 per hour. Constant and persistent effort, however, overcame the difficulties as they arose, and the depth desired, 48.4 ft. below datum or about 50 ft. below the surface of the water, was attained, and the work of drifting and constructing the tunnel advanced on the proper course to intersect the end of the tunnel* as completed from the shore. They had advanced but 15 ft. when a transverse seam showed itself overhead, through which a small amount of water at first leaked, but continued to increase notwithstanding our efforts to stop it, and finally drove the men from work and prevented us from finishing a partially constructed dam in the finished portion of the tunnel. On investigation by the diver, a crack in the bottom of the lake immediately over the leak below was found, and thinking it might be the only one, I resorted to every expedient that presented itself to stop it.

The first thing done was to clean off the sand, drive wedges in the crack, and cover a large rectangular strip embracing this crack with the heaviest duck canvas I could procure, on top of which the diver spread clay. And as a last resort, after repeated failure in trying to pump out the crib, I had several scow loads of clay, about 1,000 cu. yds., dumped over the line of tunnel and around the crib, but after all was not able with a steam pump to control the leak. But here a new revelation presented itself: on returning to the crib, after having been driven from it by a storm, we found the water standing several feet lower in the crib than the point at which we left it, disclosing the fact that the water was escaping through seams into the completed portion or shore end of the tunnel.

The winter season now upon us, (December 1st) rendered this outside work both slow and dangerous and on consultation with Messrs. Sooysmith & Son, we concluded to finish the work from the shore end of the tunnel by the use of compressed air (that mighty agent in the hands of the modern engineering expert in overcoming obstacles). As a preliminary, we secured the crib by filling it with sand and clay, removed the iron shaft and bolted a heavy cast-iron plate over the cap or flange at the top of the crib, to which the shaft had been bolted. The air-lock portion of the shaft we conveyed to the shore shaft, lowered it and conveyed it to within 5 ft. of the bulkhead at the outer end of the tunnel. Then we built brick-work solidly around it, placed a 6-in. pipe under it with a gate valve in each end, braced the lock thoroughly and connected it with a heavy air compressor on the shore by a 3-in. wrought-iron pipe. Under a pressure of 22 lbs. per square inch, we removed the bulkhead and found that the contractors had left 6 or 8 ft. of excavation in advance of the brick-work, into which the earth had fallen from overhead, and the action of the water had granulated the hardpan overhead to such an extent that it allowed the air to escape rapidly at times and in one instance the foreman found it necessary to divest himself of an outer garment to stop the escape of air. Before we were able to make any advance, the caving in had continued until the men were able to stand erect over the completed portion of the tunnel, and the thickness of the crust overhead between us and the bottom of the lake did not exceed 8 to 10 ft.

So soon as we succeeded in stopping the caving by timbering, we filled up all this portion of the cavity over the tunnel with solid brick masonry, and to enable us to continue the work, we used 2-in. angle iron riveted on to three edges of boiler iron in sheets of 2 ft. wide by 6 ft. long, which formed, when bolted one to another as the work progressed, a complete exterior arch resting on each side below the invert in the undisturbed hardpan. We thus secured the work and held the heading until we extended the walls of the tunnel, which we did on each length of 4 ft. so prepared.

The seams which showed themselves in the extension of the tunnel towards the crib, as well as the amount of escaping air on the surface of the lake overhead, showed that the whole ground between the crib and tunnel was disturbed by the dynamite explosion. We completed the work, however, making a perfect connection both as to height and alignment with the portion started and completed from the crib.

And now we met another difficulty owing to the uncompleted lower portion of the crib. So soon as the air pressure was removed, the pressure from above drove the material placed in the crib forward into the tunnel as far as the air lock, and we found that the leakage into it was more than we could draw off through the 6 in. pipe provided for such an emergency under the air lock and through the lock itself. Owing to the ice, which had by this time formed upon the surface of the lake, we were obliged, notwithstanding our hurry, to postpone operations and await more favorable weather.

*As the crib excavation progressed, the men constructing the tunnel from the shore end heard each discharge of cartridges distinctly, and as if the explosion was directly overhead, and on this account considered it best to suspend operations and brick up their work, but the calculated distance of their position was subsequently found to be exactly correct, namely 47 ft. from the center of the tunnel.

During this interval I consulted with Gen. Sooysmith & Son, and we concluded on the opening of spring to load the crib with stone or pig iron, to replace the shaft and air lock on the crib, to use a compressor from the deck of a scow and force the water before us down the crib, caulking and securing the leaks as we advanced. This plan was started, but its magnitude became apparent, and the writer decided to try another plan before involving so great an outlay of money and time.

A scow load of clay was secured, and by the help of a diver it was spread judiciously over the bottom of the lake in the vicinity of the crib, and particularly over that portion where the air had escaped so freely while the compressor was at work. This having been accomplished with as great care as possible, we opened our valves in the air lock and had the satisfaction of drawing off the water, getting in and removing the sand and clay from the crib, and constructing a brick shaft in the interior of it from a connection with the tunnel to the bottom of the lake; after which we removed the air lock, cleaned out the tunnel and turned it over complete, at a total cost to the corporation of about $35,000.

The superfluous clay surrounding the crib was now dredged, loaded on to a scow and removed some distance, which should have completed the work. But instead of allowing the bottom to assume its natural state by the gradual filling in of all the cracks and seams, the Village Trustees were advised to, and undertook to beat natural laws by covering the whole bottom of Lake Michigan in proximity of the crib with concrete, which of course tended to prevent the object desired and which was a worse than useless expenditure of money.

In the progress of this work two points were satisfactorily demonstrated, to the writer at least; First, That if in progress of a tunnel you run into a sand pocket or other unforeseen obstruction, you should exhaust every expedient at your command to push the work through it on the same line before receding and changing your course.

Second, That in case of a disturbed ground, as that met here, the best way of overcoming it is to deposit thereon a moderate amount of clay, and allow the action of the water to fill the veins and seam through which the leakage occurred, and thus enable you to accomplish your work.

Relative Mileage of Flange-Worn and Tread-Worn Wheels, Pennsylvania Railroad.

In order to show graphically some very interesting and striking facts in regard to the relative life of car-wheels when they "run to flange", as it is called and when they wear squarely in the tread, we have constructed the two accompanying diagrams from the statistics given in the recent report of the committee of the Am. Soc. C. E. on "the Proper Relation to each other of the Sections of Railway Wheels and Rails". It is exceedingly difficult to grasp the moral of such statistics from numbers only, and therefore we do not reproduce the extended table (Table A of the appendix to the report) from which the data for constructing these diagrams were taken.

Briefly summarizing the nature of the table, the Pennsylvania Railroad subdivides the causes of failure of WORN OUT wheels (excluding all wheels which fail by cracks, breakage, or slid flat from brakes) under the 7 causes of failure shown in the following table, which gives likewise the *average* comparative mileage life of wheels failing from each cause during the past 10 years. The last three causes only, 5, 6, and 7, are covered by the accompanying diagrams:

Taking an average of the past 5 years (1883-7) about *one-third* only of the total wheels condemned have belonged to the select class of "worn out" wheels included under these 7 causes of failure: wheels failing from the 3 causes represented in the accompanying diagrams will be seen to aggregate somewhat less than half of the worn out wheels only, or *one-sixth* of the total wheels removed. This small residuum is of decidedly longer life than any other class of wheels, *i. e.*, it is the class of wheels which may be said to fail from "old age" only, and it includes:

1. Wheels which fail from central or exterior tread wear, which has come too near to making a "double flange" on them to make them appear safe. This class is called on the Pennsylvania "*Hollow from flange.*"

2. Wheels which have had a similar tread wear near to the flange, which has caused a similar "double-flanged" condition, but not cut into the flange itself objectionally. These are called "*Hollow at flange.*"

These two classes of wheels might be classed appropriately under the single head of "tread-worn wheels", but we have preserved in the diagrams the technical Pennsylvania terms. In contrast with these two classes we have:

3. Flange-cut or sharp flange wheels, technically known as "Worn flange" wheels. This class of wheels is in all the diagrams represented by a dark solid line, class 1 (Hollow from flange) being represented by a light solid line, and class 2 by a dotted line.

The total number of wheels drawn on which the diagrams are based is nearly 100,000, making it by far the most complete record which could well be compiled from any existing statistics; while it is, so far as known, the only one which ever has been compiled. It sheds a great deal of light on the question of whether it is really wise to sharpen the flange-fillet radius of wheels and round off the corners of rails to make the two fit each other.

To appreciate the full significance of the diagram

Relative Mileage Life of Worn out Wheels only (excluding Slid-Flat and Cracked and Broken Wheels) on the Pennsylvania Railroad.

CAUSES OF REMOVAL (In inverse order of mileage.) 5, 6 and 7 only represented on accompaning diagrams.	AVERAGE MILEAGE, 1878-87. Baggage, Express and Postal.		Passenger, Combination and Emigrant.	
	1878-86	1887	1878-86	1887
1. Comby	62 120	70 369	53 840	60 924
2. Seams	64 880	88 974	52 150	62 916
3. Shelled out	71 290	75 483	54 980	58 235
4. Worn (not slid) flat	73 110	78 368	61 310	56 510
5. Hollow in tread at flange	75 550	59 866	63 810	37 516
6. Worn (sharp) flange	78 720	75 390	66 790	60 919
7. Hollow in tread from flange	81 810	70 866	67 450	50 504
Average of the two classes of wheels which fail from wear of tread only and not of flange (Nos. 5 and 7)	78 680	65 366	65 630	44 010
Against sharp flange wheels	78 720	75 390	66 790	60 919
Average of causes 1 to 4	67 850	78 298	55 652	59 647

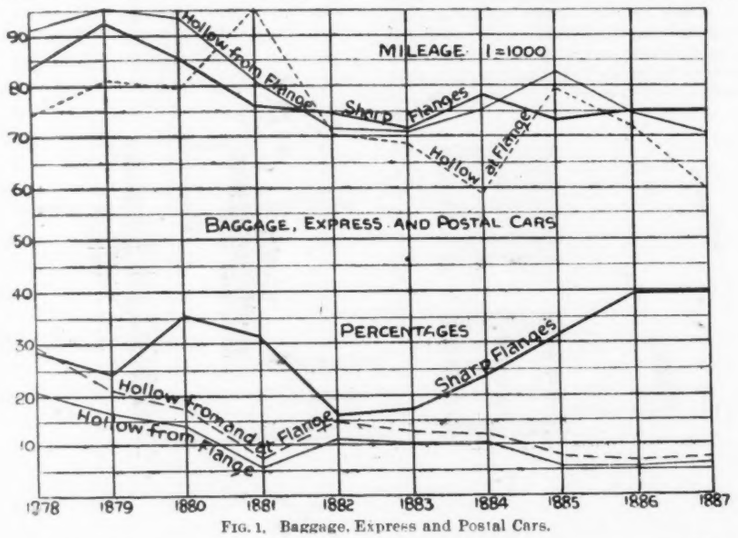


FIG. 1. Baggage, Express and Postal Cars.

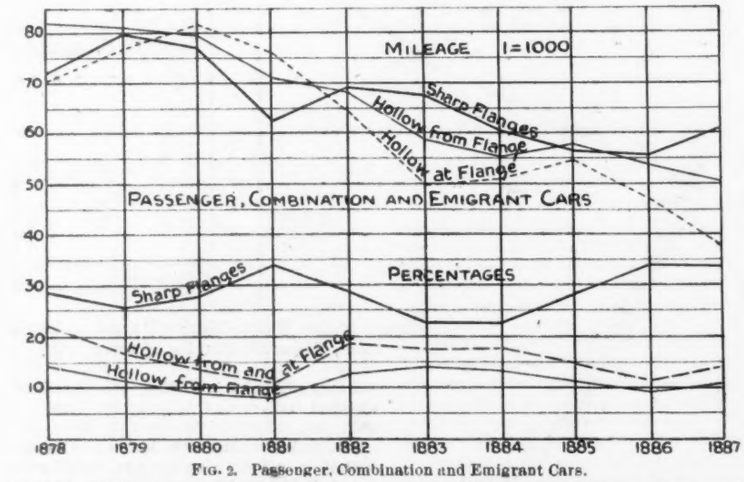


FIG. 2. Passenger, Combination and Emigrant Cars.

Relative Mileage of Wheels Failing from Tread Wear and Flange Wear on the Pennsylvania Railroad during 10 years, 1878-1887 inclusive.

["Hollow from Flange" means worn in tread away from flange; "Hollow at Flange" means worn in tread near to but not on the flange, so as to leave the form of the flange substantially unchanged. "Sharp Flanges" only means flange-cut wheels. The three classes of wheels shown all of them have a far higher mileage than those failing from any other cause.]

it must be known that the earlier Pennsylvania rail-corners were very round-cornered. About 1878-9 the introduction of a sharper cornered rail with 5-16-in. radius instead of ⅝-in. began. In 1884 the opposite theory was accepted, and the standard rail corner changed back again to a ⅝ radius, although not with the approval or endorsement of some high officers of the line, while at the same time the fillet radius of wheels was sharpened from ¾-in. to ⅝-in. to correspond to the rail corner. In 1887 this extreme in turn was abandoned and the corner radius sharpened to ½-in., but the fillet radius meantime had been fixed on as a standard by the Master Car Builders' Association, and having become an M. C. B. standard is not likely to be changed until it is done by the M. C. B. Association.

Now, it may be mere coincidence, but by examining the diagrams we can trace some singular changes in the percentage of sharp flanged wheels, coincidentally with these changes of practice; and this is true of Fig. 1 and Fig. 2 alike. Fig. 1 is for Baggage Express and Postal Cars and covers about one-third as many wheels only as Fig. 2; but these wheels have a considerably larger mileage, owing to the difference in the nature of their service, as may be seen both in the diagrams and the table.

Examining the lower part of each diagram, it will be seen that about 1880-81, when the proportion of the sharp cornered rails was becoming great, the percentage of sharp flanged wheels began to decrease, and remained decidedly small through 1882-3-4, at about 10 per cent. less than the earlier average. In 1884 came the new round cornered rail, designed to cure flange-cutting, large amounts of which have been put in each year since, until now nearly all the main-track rail has this form. If it has had any of the anticipated effect to decrease flange wear, it is certainly not visible to the naked eye in the diagrams, for on the contrary, simultaneously with the adoption of the new rail the percentage of sharp-flanged wheels began to grow, and it is now decidedly higher than it ever was before, and about double what it was before the new remedy was discovered, in each diagram alike. These diagrams being made up from records sent in from dozens of different points by perhaps hundreds of different men under regulations for classification which have remained constant, cannot have been greatly affected by the "personal equation" of changing inspectors, and it is therefore proof of a high order that they should give such coincident indications. It will be seen also that in great part the increase in sharp flanges has been accompanied by a decrease in the tread-worn wheels, although that does not explain the entire change.

The comparative mileage of these 3 classes of wheels is shown in the upper part of each diagram, and is likewise significant. It will be observed that the average mileage of all 3 classes is lower than it was 10 years ago, whereas the average mileage of the 4 classes of wheels not shown on the diagram (see table) is considerably higher. Without being able to speak positively, we think the explanation is (1) that the mileage of the classes last named has increased because of improvement in the quality; (2) that the mileage of the 3 classes of "old age" wheels has continually decreased because of more rigid inspection

Relatively to each other, at any rate, this gradual change is unimportant. It will be seen that there is no great difference between them, but that on the whole, the sharp-flanged wheels tend to show the largest mileage of all. There is no particular reason evidently, therefore, for being worried about the proportion of sharp-flanged wheels, whether large or small, besides the evident fact that in wheels which fail from wear only, the natural tendency is to have half of them run to flange and half of them away from flange. Relatively the sharp-flanged wheels have shown a tendency to increase their relative mileage, doubtless as an effect of improvement in quality, since the records show that poor wheels cut out in the flange in much greater proportions than good ones.

Without further remarks we leave the diagrams to speak for themselves. They will be found worthy of study.

—THE NIAGARA FALLS TUNNEL, POWER AND SEWER Co. is after the $100,000 premium for the best method of utilizing the water power of the Falls. This scheme, providing for 30,000 H. P., has been dormant for some time.

A Classification of Explosives.

There have been quite a number of classifications of explosives published from time to time, but the following one, compiled by Mr. WOLCOTT C. FOSTER, has proved to be very useful and full. Many powders will, of course, come under several headings:

I.—Nitro-Glycerine Powders	A—Nitro-Glycerine	a—Dope inert.	such as kiesel-guhr, dynamite, Dynamite rouge, etc.
		b—Dope partially explosive	such as Amark's explosive, Hercules powder, etc.
	B—Nitro-Glycerine mixtures	c—Dope fully explosive.	such as Brady's dynamite, Judson powder, etc.
		d—Dope unknown.	
II—Pyroxyline Powders	A—Pure nitro-cellulose		such as gun cotton
	B—Nitro-cellulose mixtures		such as Tonite, Kinetite, etc.
III—Nitrate Powders	A—Potassium nitrate		such as Gunpowder, Pyronome, etc.
	B—Sodium nitrate		such as Espirs' explosives, etc.
	C—Miscellaneous nitrates		such as Tonite, Double ammonia powder, etc.

IV—Nitro Powders, such as Nitro-Mannite, Nitro-Molasses, etc.

V.—Chlorate Powders, such as Blake's safety explosive, Callou's blasting powder, etc.

VI—Picrate Powders	A—Containing Picric acid	such as Borlinetto's blasting powder, Heracline, etc.
	B—Containing Picrates.	such as Abel's powder, Bronolite, etc.

VII—Fulminates, such as Fulminate of Silver, etc.

VIII—Chemical Compounds, such as Iodide of Nitrogen, Panclastite, etc.

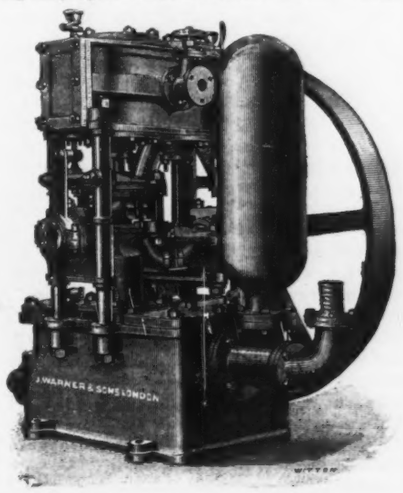
IX.—Gaseous Mixtures, such as mixtures of Oxygen and Hydrogen.

X.—Mechanic'l expl'siv's	A—Act by formation of a gas, such as Zinc and Sulphuric Acid.	
	B—Act by expansion, such as lime and water.	

XI—Dust, such as mixtures of flour or fine coal dust, etc., with air.

An Hydraulic Crowbar.

Messrs. Warner & Sons, of London, England, are introducing what they term an "hydraulic crowbar." The crowbar, according to a description which we find in *Engineering*, is in reality a jet of water driven or forced by Warner's duplex eclipse pumping engine, shown in the accompanying cut. In constructing a breakwater or harbor wall at the Grand Canary, it was found necessary to remove sand, and even large stones, before placing the concrete blocks on the rocks on the shore to form the foundation; this was easily accomplished by the jet process. It removed the sand two metres deep, and even large stones speedily under a head of 40 ft. to 50 ft., thus greatly facilitating the progress of the breakwater works. The engine used had 7 in. steam cylinders, 6 in. plungers, 8 in. stroke, and was equal to raising 120 galls. of water per minute under 80 lbs. pressure, with a steam pressure of 60 lbs. The pressure at the outlet of the jet being the same if used 50 ft. under the sea, the weight of water in the descending pipe counterbalancing the head of water outside, it enabled the 80 lb. delivery pressure to be utilized through a 1 in., 1¼ in., or 1½ in. jet.



The idea of using jets of water in this way is of course by no means new, the California hydraulic mining plant being the finest and most advanced example of it, but the idea is capable of more extended use, especially for submarine work, where weights are diminished by the buoyancy of the water.

Defective Masonry on the New Croton Aqueduct.

The following evidence, given on Jan. 7 before the Fassett Senate Committee by Mr. GEORGE S. RICE, Assistant Chief Engineer, shows that our articles of Oct. 13, 1888, on bad work in the New Croton Aqueduct, were altogether too mildly drawn:

Mr. RICE first stated that he was in charge of the inspection for bad work and that the job was yet incomplete. He estimated that it would cost Brown, Howard & Co. over $600,000, and O'Brien & Clark $400,000 to repair the defects on their contracts. About 2 months hard work would finish these repairs. Mr. RICE then says:

"Bad work was found on all the divisions. That in charge of JOHN M. WOLBRECHT, the Second division, was the worst in the lot. I should think that fully $400,000 of the $1,000,000,000 would be requisite for repairs on that division. FISHER MORRIS had charge of the Fourth division and $225,000 will cover his defective work. A similar amount will probably pay for the section in charge of Division Engineer CHARLES GOWANS. There was defective work to the extent of $75,000 on ALFRED CRAVEN'S division. Work on the Fifth division, began since the investigation, shows a decided improvement. The aggregate cost of making good the defects on this division will not exceed $20,000.

"I suppose the division engineers are responsible for the bad work. I don't see just how the condition of affairs discovered could exist without their having knowledge of it. Messrs. Gowans and Craven are the two division engineers who were at war with the contractors and kept making complaints about the work to the Aqueduct Commissioners. It was Division Engineer Gowans who first called public attention to the bad work and started this investigation. I don't see what was to prevent Wolbrecht and Morris from having knowledge of the defects. If they ever made any complaints I have not discovered them. I was told that they were the two division engineers who could get along peaceably with the contractors, while there was a constant fight between Craven and Gowans and the contractors under them. So far as I know Craven and Gowans were conscientious and tried to do their duty by the city."

"My inspection revealed hundreds of places in the tunnel where a single ring of brick, instead of three, as called for, had been built. There were also scores of places where the backing consisted only of empty cement barrels, I removed not less than 1,000 of these barrels, and the space has been filled with rubble masonry. Division Engineer Wolbrecht told me that my discoveries were a complete surprise to him, and he could not account for the condition of the work."

At the conclusion of this testimony and some minor business, Chairman FASSETT was prepared to adjourn indefinitely, but Contractor O'BRIEN made an appeal for another hearing. He claimed that Mr. RICE had greatly exaggerated the cost of patching up the tunnel and that the extra cost to his firm would not exceed $80,000 to $100,000. The committee decided to meet again this week.

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EDITORS.
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Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also,* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

Coming Technical Meetings.

Engineers' Society of Western Pennsylvania, Pittsburg, Pa.—Regular meeting, Jan. 15. Secy., S. M. Wickersham, Penn. Bldg.

American Society of Civil Engineers, New York.—Annual meeting, Jan. 16. Excursion and reception, Jan. 17. Secy. John Bogart, 127 E. 23d St.

Engineers' Club of St. Louis, Mo.—Regular meeting Jan. 16. "Wrought Iron and Steel Eyebars", Carl Gayler, "A Burr Truss", Prof. A. E. Phillips, Secy., Wm. H. Bryan, 709 Market St.

Boston Society of Civil Engineers, Boston, Mass.—Regular meeting, Jan. 16. Secy., S. E. Tinkham, City Hall.

New York Railway Club.—Next meeting Jan. 17. Rooms, 13 Liberty St., New York City.

Engineers' Club, Philadelphia, Pa.—Regular meeting, Jan. 19. Secy. Howard Murphy, 1122 Girard St.

Engineers' Club of Kansas City, Mo.—Regular meeting, Jan. 7. "Electric Railways", A. M. Connett. Secy., Kenneth Allen, Y.M.C.A. Building.

Civil Engineers' Club of Cleveland, O.—Regular meeting Jan. 8. Report on Architecture Secy., James Ritchie. Case Library Rooms.

American Institute of Mining Engineers.—The 53d meeting will be held at New York, on Feb. 19. Secy., R. W. Raymond, 13 Burling Slip, New York.

THE two great sections of the country whose development has been the most marked feature of the present decade are the South and West. Extravagant statements are frequently made concerning the rapidity of development in each of these sections as evidenced by the work of railway construction. To show just what the progress of railway extension has been in these two sections for the past 8 years, we have taken nearly equal areas of the two sections and show in the following table the railway construction in each during that time.

In the South we have included Virginia, West Virginia, Louisiana and all the states south of the Ohio, and east of the Mississippi, making a total area of about 486,000 square miles. To take a nearly equivalent area in the West, we have included the States of Wisconsin, Minnesota, Dakota, Iowa, Nebraska and Kansas, whose extent exceeds the other by only 13,000 square miles and which include nearly all the prairie region of the West where railway extension has been in active progress during this decade. The showing for the two sections is as follows:

YEAR.	11 SOUTHERN STATES	6 WESTERN STATES.
1881	1,321	2,198
1882	1,598	2,402
1883	1,394	1,386
1884	1,193	1,322
1885	804	915
1886	1,233	4,202
1887	1,695	4,800
1888	2,054	1,356
Total	11,282	18,771
Sq. miles area per mile built	43	27
Total Mileage	26,765	37,358
Sq. miles area per mile of total mileage	18.1	13.3

IT will be seen from the above that the past year was the only one in which the given Southern area has ever exceeded the Western area in its total of construction, though in 1883 the two records were practically equal. The increased mileage per square mile of area in the West over the South is notable. This is to be explained by the fact that the chief products of the latter section, grain, live stock, etc., are much heavier and are more largely shipped by rail than those of the South; and also by the fact that many of the Western roads are necessary for through traffic between Eastern markets and points farther west.

Another striking feature of the table is the steady growth of the South and the sharp fluctuations in construction in the West. During the four years from 1881 to 1885 the record of the South varied less than 400 miles. In 1885 construction fell off, as it did in almost every section, but not so seriously. Since that date, the increase in each year's construction over the preceding has been almost exactly 450 miles. This is in contrast with the ups and downs of the West, which built nearly five times the mileage in 1886 that it did in 1885 and but little more than a quarter as much in 1888 as in 1887.

THE suggestion of one of our correspondents that the elevated roads of this city be utilized as carriers of electric wires, while not altogether novel, is one well worthy of more study than has yet been given it. The narrow and long-drawn-out conformation of Manhattan Island and the location of the present elevated structures adapt the latter admirably for the disposal of main lines of wires. So far our underground system seems of very little utility, when we consider that in the three years consumed in its construction, overhead wires have increased in number in the face of an alleged capacity for over 34,000 miles in the conduits already buried in our streets. It would not seem to require much engineering skill to devise some plan by which many miles of wires could be conveyed under and alongside of the trusses of the elevated road, and thus assist the Board of Electrical Control in its task of ridding north and south streets of the objectionable poles. If simply used as an adjunct to the subways in this way, the gain would be great, for it could be made immediate, and no one would doubt the efficiency of the wires so disposed of. The poles are the chief obstruction to travel, especially on narrow streets, like Nassau for example; and the close proximity of the network of wires to the house line is an obstruction and menace to firemen. Both of these evils could be at least lessened materially in degree by the elevated roadway disposal. Efficient and permanent subways are doubtless a truer solution of the problem. But the present alleged system of water-logged conduits, steam-heated sheet iron pipes and the presence of corroding gases in the underground ducts and manholes, can hardly be classed under the category of efficient or permanent. Any solution, therefore, that promises quick returns at a comparatively slightly increased expenditure should be carefully studied. We do not know what the elevated railway companies may have to say to this plan; but as these wires should not interfere with their use of the structures in any way, and as the companies pay the city comparatively little for enormous privileges, they should be willing to give all the aid in their power.

WE have obtained through the kindness of Mr. T. A. KNICKERBACKER, President of the Cohoes & Lansingburgh Bridge Co., of Troy, N.Y., a very satisfactory answer to Mr. THEODORE COOPER'S query of as to whether there was any modern bridge still in use in the United States of older date than that built by TIMOTHY PALMER across the Delaware at Easton, Pa. in 1806. It appears from Mr. KNICKERBACKER'S note to us that there is one in New York antedating it by at least 3 years, and very possibly there are others; as to which or as to any other interesting facts bearing on the development of bridge building in America, we shall be pleased to receive details.

Mr. KNICKERBACKER writes:

"The Union bridge of Waterford, N. Y., was built in 1803; all of hewn pine, cut within 12 miles of the bridge, which is 800 ft. long, in 4 spans, 32 ft. wide, and looks as if it would last 100 years longer. The old sign '*One Dollar for passing faster than a walk*', shows that the old fashioned *s*, was used in those days. The engineer in charge of the work was to be paid $5.00 per day; the carpenters and builders received $1.50 and 3 glasses of new rum each.

"When the bridge was opened there was as much ado made as for opening the Brooklyn Bridge; as the Governor, Senate and Assembly were asked to come up and walk from the hotel (it was a 'Tavern' in those days) in Lansingburg over to Waterford, a mile or more. The bridge is now still owned by the same old Knickerbacker family."

We shall at an early date give further details of the design and present condition of this interesting structure, which certainly seems to be an argument in favor of serving out "three glasses of new rum per day" to the workmen, not to say, of paying "engineers in charge" $5 a day. Few of them care to work for that stipend now-a-days, but few of them likewise put up bridges which will be standing 86 years from now, even of iron and steel, unless it comes in fashion to build lighter engines instead of heavier ones.

AN officer of the Allegheny Valley Railroad writes us:

"We were agreeably surprised to note in a recent number of your journal (ENG. NEWS Nov. 10, 1888) your gratifying comments upon the performance of our motive power, I have sometimes wondered that with the same light type of engines that were in use on this road in the early seventies, we should now be able to haul such far heavier loads than before; for it is not only the increase in the number of cars, but the large increase in the lading of each car, consequent upon the general use of 60,000 instead of 40,000 lbs. cars, that is to be considered. If we do say it ourselves (as perhaps we "had'nt ought to") our engines are kept in highly serviceable condition, and our track has also been greatly improved during the period covered by the table you quote from."

The growth noted was certainly extraordinary, and that the greater part of it was due to increase in the load per car is at once shown by the figures. Thus, the ton miles per year per engine increased from 1,702,504, in 1876, to 3,636,982, in 1887 or in the ratio of 1 to 2.13. The number of cars per train increased on the River Division from 20.1 to 28.0 (1 to 1.39) and on the Low Grade Division from 18.9 to 20.0 (1 to 1.06); an average say of 25 per cent. increase in number of cars; indicating that the average load per car has increased in the ratio of about 1 to 1.7, which is just about what we know it has increased in average practice. It is not to be wondered at, in the face of such a showing, that the road has been content to continue in use its old and light type of engine but that it is a mistake to do so and that con-

siderable further economy can and will be realized by heavier engines is hardly to be doubted. That the engines must be in somewhat higher condition than they used to be, follows almost of necessity from such a record; but a leading cause must have been the steady improvement in the track and in the vigilance of administration, especially in respect to train despatching. When a freight train was liable almost any time to have to make passenger speed to follow orders as used often to happen "in old times" (10 or 15 years ago) very heavy loading was impossible.

THE proposed increase of capital stock of the New York, New Haven & Hartford Railroad leads the Hartford *Courant* to make the following interesting contrast between 1872 and 1888:

	1872	1888	Increase
Miles operated	206	508.08	302.08
Engines	84	199	115
Cars	1,431	4,590	3,159
Employés	2,117	5,591	3,474
Passengers	3,925,705	11,835,812	7,910,047
Total income	$4,483,584	9,970,039	5,486,455
St'k own'd in Conn.	$5,122,500	6,626,500	1,504,000
Stockholders in Conn.	1,134	1,884	750
Capital stock	$15,500,000	15,500,000	none
Debt	$1,641,500	2,000,000	358,500

There have been also some noticeable items of decrease as follows:

	1872	1888	Decrease
Average fare per mile	2.25 cts.	1.77 cts.	0.48 cts.
Ave. charge ton per mile	3.75 cts.	1.95 cts.	1.80 cts.

Passenger rates have gone down 20 per cent. and freight rates 50 per cent., which is a considerable reduction, although by no means as great as many much larger systems have made from much smaller rates. The property is an extremely valuable one, and there is some opposition to the issue of stock, as unjustified, but not such as is likely to be effective, nor does it seem to be founded on justice. Until the public is prepared to guarantee investors against losses, the equity of attempting to guarantee them against profits (?) except by insisting that rates shall be reasonable, is not apparent.

The proposed increase of stock is for the purpose of paying the company's funded and floating debt, to acquire the ownership of the securities of its leased lines and to provide for the expense of improvements to its permanent way, of which the removal of grade crossings and a large amount of double and quadruple tracking are the most important.

WE are requested to state that the price of Mr. M. LORINI's graphic traverse table, which was recently stated in these columns to be 50 cts., is in fact $1.00; at which price, we may add, it will be found cheap for those having many traverse calculations to compute or check. It can be obtained from this office or elsewhere on receipt of price.

The Presidential Contest in the Am. Soc. C. E.

A question of procedure in connection with the pending contest for the presidency of the American Society of Civil Engineers has been called to our attention, which appears to be of more than passing moment, affecting profoundly the permanent good of that body: The constitution provides by Sec. 24-1st. of the By-Laws that:

"Votes for officers * * * may be sent by mail enclosed in two sealed envelopes, the outer one of which shall be endorsed by the voter's signature, and all such votes shall be counted in the first ballot for officers.."

The purpose of the closing clause is explained in the next paragraph, which provides that in case of non-election by a majority, the Annual Meeting shall proceed to "vote by ballot in the usual way", as each member may if he choose at the first ballot; but in practice all voting for many years has been by letter ballot only.

The 3d and 4th paragraphs of the same section provide for regular nominations and for the issuance of letter ballots therefor by the Board of Direction "at least 20 days before the annual meeting", or about Dec. 25. To provide for opposition nominations the 5th paragraph provides:

"Any five members, not officers, may present to the Board of Direction *on or before Dec.*1, a list of names proposed by them for officers, *which list or lists shall also be issued for ballot.*"

The implication is distinct that the two ballots are to be issued simultaneously (otherwise, why the stipulation as to date?) and with precisely similar enclosures. There is no provision requiring the names of the proposers of the opposition ticket to be made public, nor is the exact form and style of ballot specified.

As far as the written law is concerned, the opposition ballot violates no legal requirements, but the manner of issue is open to criticism. These ballots were very similar in appearance to the regular ballot, and though printed in blue were sufficiently like the other to deceive the careless member into voting it as a regular ballot, especially if he had thrown away the first ticket sent out by the Society and regarded this simply as a second notice to cast his vote. Every ballot counted at a business meeting of the Society proves that this carelessness in examining the ticket voted is only too common among its members, and every precaution should be taken to prevent such a blunder counting for or against a candidate. The objectionable feature was the failure to issue with the opposition ticket a circular—such as we print this week—calling particular attention to the fact that there was another ticket in the field and giving some reason for its issue. Such a warning would only have been fair to all concerned and would have made the action of the opposition unobjectionable in form. We are told that this omission was intentional, and done with the purpose of leaving the choice of candidates purely to the individual judgment of the member receiving the two tickets, uninfluenced by other reasons than those he could furnish from his own knowledge of the candidates. This was an unfortunate procedure for the reasons given above.

There should be in the new constitution a clause defining exactly the manner of putting in nomination an opposition ticket, and requiring that it be sent out either as a part of the regular ballot, with orders to scratch the names of parties objected to, or at least in the same enclosure as the regular ticket. This would put both parties on a just and even basis as far as nomination is concerned, and place the responsibility of a selection upon the membership, where it belongs.

Another Society feature of long standing that should be abolished is the privilege resident members now have of inspecting the list of members casting ballots, an inspection which permits them to know who have and who have not voted, and to act accordingly in soliciting non-voters or in speculating upon the volume of the vote. This list should be as sacred as the ballot itself, for it requires very little knowledge of political methods to see how this privilege can be used to the disadvantage of an unsuspecting candidate or his friends.

That there is felt to be force in these objections is also indicated by the circular which appears in another column from some of the proposers of the opposition ticket. Had such a circular appeared sooner, there would have been no necessity for this article; but now that there is a possibility at least that some careless voters may have mistaken the opposition ballot for a second regular one, why should not both sides agree that, if it be found that the result of the election will turn on such votes, the whole ballot shall be declared informal, and a new one ordered which will then be beyond question and beyond all danger of establishing a dangerous precedent?

Improvement of Country Roads.

It is an encouraging sign of progress to note that GOV. BEAVER, of Pennsylvania, and GOV. AMES, of Massachusetts, have in their late messages taken up the question of improving the country roads of their respective States. GOV. AMES strikes the nail on the head when he says that "the knowledge and skill required to construct and maintain good roads and bridges in the most economic manner, requires long experience combined with good judgment and a special knowledge of the relative value of available material." This is the whole story in a nut-shell. Good road construction in Europe enlists the services of the best engineers the country can afford, men fully possessing the requirements blocked out above. And the result of this, and of a better administration in various other ways, is a highway system that is a credit to its projectors and a benefit of vast public importance to the people who use it and pay for it. But to improve upon the present slip-shod and utterly worthless methods that have been handed down to us from generations too poor or too careless to do otherwise, we must have legislation, and hence the encouraging feature of the messages referred to and elsewhere given, which both recommended the authorization by the legislature of a more thorough and intelligent system.

The suggestion of the *Evening Post* of this city that the county manage the main roads, and the smaller towns tend to the cross-roads, is good as far as it goes; but all the roads in a county, main and cross roads, should be under one intelligent supervisor as far as the method of their construction is concerned, otherwise there is sure to be a conflict of authority and a decreased public value to the work done. Good roads cost money, and this expenditure should be justly divided among the citizens; but whatever is done, be it much or little, should form part of some comprehensive and sufficient system that can be improved upon year by year until all the roads are good. The great fault of the present so-called system is that what money or labor is expended is forever wasted; and while the aggregate expenditure of past years is enormously great throughout the country, the roads, as a rule, are worse than they were in the coaching days of 50 years ago.

As to the engineering supervision which is absolutely essential, one man who understands his business can, with a very small corps, assume the responsibility of laying out and attending to the roads of a whole county. But this man must have full authority to enforce his plans, and power to engage competent superintendents to see that the work is being properly carried out—by skilled laborers preferably to the present system of "working out a road tax." The latter method of "doing" public work belongs to the day when hard cash was scarce and taxes were paid in onions or tobacco; the excuse for it no longer exists, and the result of such undirected and unintelligent work is generally an outrageous public nuisance rather than the public benefit it is theoretically supposed to be. Even the present road taxes, paid in cash and expended under competent direction, should give us roads immeasurably better than the average of to-day, and enable us to make a permanent gain in this direction that would lead well on towards the desired end. And it should not be

forgotten that a road once properly constructed and properly watched and attended to would really cost the community it serves much less annually than the yearly tinkering at roads, which are simply quagmires when they are most required. It is high time to abandon the methods of a generation that lived in the woods and regarded a three days journey between New York and Philadelphia as "quick traveling." And the shortest cut towards improvement lies in the enactment by our Legislatures of such new laws as a conscientious and intelligent commission appointed to study the problem may advise. But in enacting a law, see that the power to enforce it forms an essential part of the document.

It is to be earnestly hoped that the action of the governors of the two great States named will stimulate an interest in other States, as it already has done in New Jersey. The remarks of Governor BEAVER apply with equal force to all parts of the United States, for all sections are practically working on similar antiquated and utterly inefficient methods. The *Journal*, of Elizabeth, N. J., says editorially, in commenting on this question, that millions of money have been thrown into the mud-holes which in certain parts of that State are called roads, with the only result that they are as deep, thick and dangerous as in 1789.

It is said that the prospects are good for the New Jersey Legislature taking up this question at its next session, and in Union county of that State, a well defined and representative movement is now reported as under way with this same end in view. The plan proposed by those interested in county roads about Elizabeth, Plainfield, Rahway, etc., is to petition the Legislature for a bill to authorize the Board of Freeholders, or some other county commission, to declare certain roads county highways to be worked in the county interest. The petitioners properly argue that it is now economy to build roads permanently and substantially, and they proceed to use the same further reasons advanced by Governor BEAVER, regarding the comfort of individuals and the wear and tear of vehicles, harness and beasts of burden. It is not a question of building new roads but of improving existing roads.

The whole question is one in which the interest is so wide-spread and important that it would seem to only require the calling of public attention to the fact, to obtain substantial support. But the public is a strangely apathetic animal; and its hide is so thick that nothing but the most vigorous and continuous use of the club will really awaken it to a true sense of duty, or drive it out of a rut it has patiently traveled for generations. The question of better roads is not one that can be disposed of in a day or a week; it must be carefully studied in all its bearings, present and future, and persistently stuck to until some proper and efficient method of improvement is formulated. Then enact binding laws, and enforce them as rapidly as the financial condition of the community affected will permit and the importance of any certain highway to the general public should demand.

Brass Measuring Tapes.

We have received the subjoined letter of inquiry, which in part speaks for itself, but which seemed to us to warrant more extended comment than is admissible in an appended note:

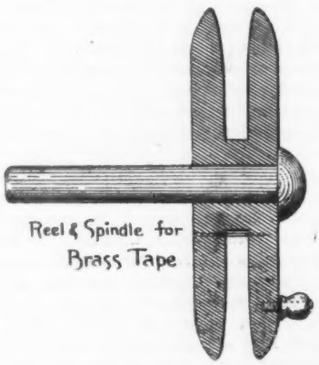
Orange Belt Railway Co.
OAKLAND, Fla., Dec. 31, 1888.

EDITOR ENGINEERING NEWS:

Being much interested in exact measuring instruments, I would be pleased to have you inform me where I could obtain one of the "brass tapes used around Boston" which you speak of in the last number of ENGINEERING NEWS. It is a new idea to me, and seems to me must be valuable, as the breaking of steel tapes is their greatest drawback. Is the ribbon bought plain, and does each purchaser do his own graduating? Yours truly,

A. J. G.

Perhaps some of our Boston readers will inform us where these brass tapes can be had, and the present state of Boston practice in regard to them. Our own information dates from personal experience of more than 20 years ago; but from that experience, which covered several years, and was followed by still longer experience with steel tape, our conviction is decided that the brass tapes referred to is in every way and from every point of view the preferable measuring instrument for general use; and we are amazed that they are not more used. In old days they used to be bought plain for about $3 per 103 ft. and graduated on a 10 ft. rod (to which they were clamped by ordinary cabinet-



maker's clamps in 10 ft. lengths) using a common gold pen and chloride of platinum ink, first making a little scratch with a fine awl to ensure permanency of graduation if the platinum wore off, and to guide the pen in the exact mark desired in making the visible graduation. The platinum ink leaves a decided black mark, like ordinary ink on paper, and much clearer than steel graduations. It gradually wears off, but is as easily renewed as pen marks on paper, in a few minutes' time of any rainy day, and the scratched graduations never need renewal during the life of the tape, which is apt to be a long one. After graduating, the entire tape is tested on a standard 100 ft. and 50 ft. base, and the temperature determined at which the graduation is exact. This temperature will sometimes differ a few degrees on the first 50 ft. and the entire 100 ft., but rarely enough to need consideration, as all long measurements are made with the full 100 ft. In this way no special care is needed to ensure exactitude in the measures at the temperature of graduation; *uniformity* in the spacing only is particularly important, and since all long measures, as before stated, are made with the full tape, and only the fractional remnant with any of the intermediate graduations, a slight lateral displacement of one of them cannot result in errors of moment in the most delicate engineering or surveying measurements, and a displacement of over 0.001 ft. can only occur from needless carelessness.

By this method of graduation it cannot be foretold in advance within 20° what the standard temperature will prove to be; it may vary 10° either way from the average temperature at the time of graduation; but since temperature corrections must be made in any case, *and with a brass tape are strictly decimal* (0.01 per 100 ft. for 10° Fahr. difference of temperature) it matters little whether we must correct for 25° or only 5°. In fact, it is rather better to have the correction large, for the reason we have previously pointed out, that without constant practice and a tolerably clear head, it is the easiest thing in the world to make these corrections exactly wrong, and so double the error from temperature instead of correcting it.

Assuming a given difference of temperature of say 22° from the standard, necessitating a correction of 0.220 ft. in a measured distance by the tape of 1,000 ft., there are these four cases, between which confusion may arise:

Temperature above Standard:

1.	Laying off a fixed distance;	Correction —, or to be subtracted
2.	Measuring between fixed points;	Correction +, or to be added.

Temperature below Standard:

3.	Laying off a fixed distance;	Correction +
4.	Measuring between fixed points;	Correction —

To obviate the necessity for these corrections, which with steel are not decimal (being nearly $\frac{2}{3}$ of the brass corrections) various instruments to alter the length of the steel tape are more or less used, but they add to its complexity, and we do not think are as really useful and certain as this simple method of correction, once only for each distance measured, if the distance be a mile.

The box in which these tapes are carried is as simple as the tape itself, being only a turned black-walnut spool of the form shown in the accompanying illustration, through which a loose spindle fits. Except when in use the spindle is removed, thus enabling the tape to be easily carried in the pocket. A brass pin holds the inner end of the tape in place, and a small turned knob outside is used for winding. The reel and spindle complete costs about 35 cts., are readily examined in every part, and often outlast several tapes. Vulcanized fibre, indurated fibre, or celluloid, would now furnish better materials than wood, but the general style of construction can hardly be improved on. The closed cases in which steel tapes are usually mounted are more taking to the eye, and have a less home-made look; but they are not really more convenient, and if the tape breaks, work has to stop, whereas with a brass tape, either of the broken halves can still be fitted into the box and used.

As we have before stated, the main graduations are for even feet only, and tenths and hundredths are obtained from a "minus foot" beyond the zero of the main graduations, as with the architects' scale. Thus, to lay off 57.235 ft., one end of the tape is held at 57 and 0.235 laid off at the other end from the "minus foot". In measuring a fixed distance this makes it occasionally necessary to let out or take up a foot, but it is not an appreciable inconvenience or delay.

The kinks and twists which break a steel tape simply make a sharp bend in a brass one, which is forthwith straightened out by the simple process of laying the bent part across the box and rubbing it with the round knob of the spindle; but as the original length may not be exactly restored, and as there is apt to be less care taken (and time lost) in avoiding kinks than when a kink means a break, the length of the tape does not remain absolutely constant throughout its life, but will change 2° or 3°, or even more; but this only means a test by the standard every few weeks, which will usually prove to have been superfluous. The successive standard temperatures are cut on the box or written with the chloride of platinum ink upon the tape. A bit of emery cloth readily takes off such marks when desired, and leaves it clean for new inscriptions. It takes a very vicious jerk combined with a kink, or repeated bends in the same place, to break a brass tape, and if broken it is readily patched by soldering, and nearly as good as before. The outer end of the tape beyond the "minus foot" is bent over and soldered in a

loop, through which a leather or catgut string is tied. In this the finger is inserted for ordinary measurements, and the hook of the smallest and cheapest spring balance to be found in the shops (cost, about 18 cts.) is inserted for accurate measurements. The balance is especially necessary if the tape is sagged; otherwise the proper tension can be guessed at fairly well. With the standard tension of 8 lbs. the sag is 0.030 ft. for 100 ft., and 0.010 ft. for 50 ft. The width is about $\frac{5}{16}$ in., and the tape has a very low spring temper, so that it must be bent flat back several times to break off. The thickness is about that of an ordinary visiting card.

Such was the Boston tape of 20 years ago, and such, if we are not mistaken, it is to-day. For practical work, using "practical" either in the sense of convenience or accuracy, the steel tape, in our judgment, is a poor thing beside it; and at least it is certain that work was done with such brass tapes which has not been, and is not likely to be, surpassed anywhere in any city work. The Back Bay improvements of Boston, on the part laid out by Prof. JOHN B. HENCK, were a marvel of exactitude, considering that no paraphernalia of rods and that sort of thing were used in laying them out, but that all measurements were made with the simple instrument described. We question if there is any more accurate work on the continent. The city of New York was laid out with rods, and that work at least does not approach the Boston work in accuracy.

It may be that Boston has had some new light on this subject that we do not know of. If so, we shall be glad to know of it; but we do not see how any one can have devised a really more convenient measuring instrument for general use; one which may be used quite roughly and hastily where exactitude is not demanded, but may in the next minute be used without a change and with but little more loss of time for the most accurate and precise measurements ever demanded in engineering and surveying practice.

We fear dealers in engineers' supplies would not look with great favor on the general use of these tapes, as they cost little and last long; but if any one of them is now prepared to furnish them, or chooses to equip himself to do so, we shall be pleased to announce the fact in these columns, and we see no reason why he should not make a great hit with them. A complete outfit should include graduating rod and clamps, chloride of platinum ink, spare spindles (which are sometimes lost) and spirit lamp and blow-pipe for soldering; and when sold they should be graduated, although that did not use to be the practice in old days.

A "Vestibule" Train in England.

The London, Brighton & South Coast Railway Co., which has been running Pullman cars on its express trains for several years, has now put on a train made up of three first-class cars and three Pullman cars, the latter being fitted with the vestibule device. The first run was made on Dec. 10. The three cars are royally named; "Princess", "Prince" and "Albert Victor". The first is intended for ladies traveling alone or with gentlemen; it has 19 revolving chairs and 8 sofas; there is also a boudoir and dressing room. The windows are wide and lofty. The interior is furnished in Australian mahogany and upholstered in blue. The "Prince" is of similar style and finish, has 17 revolving chairs and 9 sofas, and is fitted with a buffet, library, writing materials, etc. The "Albert Victor" is the smoking car, and has 30 stationary seats and 10 wickerwork chairs; it is finished in oak and upholstered in brown. The cars are 58 ft. long, 8 ft. 11 ins. wide over the eaves and 13 ft. 2 ins. high from the rail to the top of the clerestory; they are carried on 4-wheeled trucks; the wheels and axles being of the railway company's standard. They were built at the Pullman Company's works at Detroit, Mich., and shipped in sections to England, where they were erected at the railway company's shops. The cars are lighted by electricity, fitted with electric call bells, and thoroughly heated and ventilated.

A special van, of the same external appearance as the cars, has been built by the railway company for carrying the electrical apparatus for lighting the train. The Brush dynamo is driven by two link leather belts from the van axle, and a sufficient number of accumulators are provided to meet all possible emergencies. The dynamo is fitted with an ingenious regulator, which switches off the current the moment the speed falls to a point at which the accumulated E. M. F. would exceed that of the dynamo. The train has been built under the supervision of Mr. JOHN MILLER, the manager of the Pullman Company in Europe. The cost is estimated at $15,000 per car; $2,500 for the dynamo and baggage car, and $12,500 for the engine, a total of $60,000, exclusive of the first class cars. An extra fare of 25 cts. above the ordinary first class fare is charged on these cars.

The engine is one of the peculiar type of express locomotives designed by Mr. STROUDLEY, the Locomotive Superintendent of the road. The cylinders are inside, and the four coupled driving wheels, 6 ft. 6 ins. in diameter, are at the front of the engine, with a single pair of smaller trailing wheels. Its weight is 56 tons. Mr. STROUDLEY is in favor of maintaining a uniform moderately high rate of speed for the whole journey, and on the Brighton line, about 50 miles long, the speed never rises to 60 miles an hour, although the run is made in 1 h. 5 m. To obtain this uniform speed over the heavy grades, the engines are designed with large boilers and extensive grate surface. The London and Brighton line of the L. B. & S. C. system may be called a "fashionable" line, as Brighton (which has been dubbed London-on-the-Sea) is a favorite place for residence for wealthy business men, and it is the policy of the company, therefore, to maintain a luxurious and fast train service for the accommodation of this class of passengers. This train makes two round trips on week days and one round trip on Sundays.

Review of the Year's Iron Trade.

In a review of the American iron trade for 1888, the *Bulletin* of the American Steel Association says:

"The past year has been one of lessened activity in the iron trade of this country as compared with 1887, but if mere production be considered, it will be found, with one important exception, to have been fully as active a year as 1886, which was the most productive year in our iron history except 1887. Both 1886 and 1887 were booming years for the American iron trade, but the latter was not only more productive than the former but it was also a more prosperous year.

"Our total production of pig-iron in 1886 was 5,683,329 gross tons; in 1887 it was 6,417,148 tons; in 1888 it has been in excess of the production of 1886, and is probably about 6,000,000 tons. The decrease in 1888 has been altogether in Bessemer pig-iron. Our production of Bessemer steel rails in 1886 was 1,574,703 gross tons; in 1887 it was 2,101,904 tons; in 1888 it has been about 1,350,000 tons, which is a great shrinkage as compared with 1887, and is considerably below the production of 1886. This is the exception to the activity of 1886, which is above mentioned, and it has great significance. In the production of bar-iron and plate and sheet-iron, and in the aggregate production of cut and wire nails, the figures for 1888 will not vary greatly from those for 1886, while our production of structural iron and steel was greater in 1888 than in 1886, and probably greater than in 1887. This country has in late years developed a large demand for iron and steel for all structural purposes, particularly in the erection of public buildings.

The consumption of iron and steel in the United States in 1888 was much less than the estimated figures of production which we have given would indicate. While our importations of iron and steel in 1888 were nearly, if not altogether, 950,000 gross tons, they nevertheless fell far below the importations of 1887, which reached the enormous aggregate of 1,783,251 tons. With reduced production and reduced importation of iron and steel, exact figures for neither of which will for some time be accessible, we have estimated from such data as are at hand that our consumption of pig iron in 1888 has fallen fully 600,000 tons as compared with 1887, and our consumption of steel rails about 800,000 tons.

"Among the industries which consume iron and steel, the building of locomotives and railroad cars of all kinds has been very active all through 1888.

"In mere productiveness it will seen that the leading branches of our iron trade were not evenly balanced in 1888, but when we come to look at the prices of the year we find just as wide variations. Bar iron and nails were sold at almost ruinously low prices all through the year. Best brands of gray forge pig-iron declined about $1.25 per ton from January to August, but in the closing months were a trifle firmer in prices; inferior brands of gray forge declined about $2 during the year. But best foundry pig-iron dropped during the year from $21 to $18, and steel rails from $11.50 to $28 as a rule, and in exceptional cases to less than $27, but not to less than $26 at Pennsylvania mills as has been stated. The low sales were made late in October and early in November. The market soon rallied to $28. Several Bessemer steel companies have refused to make rails at prices recently prevailing, and their works are closed or running on other specialties. Old iron rails advanced $3 in price during the past six months of 1888, standing at its close $2 above the highest price in the preceding six months. It is a most curious fact that a ton of old iron rails and $4 will now buy a ton of new steel rails of the best quality."

ENGINEERING NEWS.

——THE PORT HURON TUNNEL excavation on the American side will begin about 2,500 ft. back from the river, and from this point there will be a steady decline till the necessary depth under the bottom of the river about 50 ft., is reached. The drift for the tunnel proper will be 22 ft. in diameter and the distance from one river bank to the other is 2,200 ft. The tunnel will have a drop of 90 ft. to the mile, the lowest end being on the Canadian side.

The work of excavating in the tunnel will be done with large steel "shields", 22 ft. in diameter, as described in our issue of Dec. 15, driven into the earth with 24 hydraulic jacks, each with a pushing force of 125,000 lbs. Five railway tracks for small trucks holding 2 cu. yds. will be laid in the bottom of the tunnel. A cable running from a large hoist engine through the tunnel to the cars will pull them up to the surface, where the dirt will be loaded into other cars to be carried away. A gang of men will follow with the cast-iron lining of the tunnel. A monster blower engine forces air into the tunnel through a 24-in. pipe. A large electric light engine will furnish 300 lights, and it is proposed to make the interior of the tunnel as light as day. A force of 125 men will be employed on each side of the river, and the work will be pushed night and day.

It is expected that the workmen from each side will come together about 700 ft. from the Canadian side. The approach to the river is nearly a mile longer on the Canadian side than on the American, as the up grade is all on the land side in Canada. The approaches will not be tunneled until the tunnel under the river is completed. The tunnel, as finished, will consist of 2,500 ft. on the American side, 2,200 under the river, and 4,000 ft. on the Canadian side. There are now at work 125 men on the Canadian side, and 60 on the American side. It is estimated that the work will cost $2,500,000, although it may be nearer $5,000,000. President Sir HENRY TYLER and Manager HICKSON, are said to declare that it will be completed if it costs $10,000,000.

——THE JULIEN ELECTRIC TRACTION CO. expects to run 12 cars on its system on the Fourth Ave. road this winter. A general order was passed by the Board of Aldermen last month permitting the Harlem River Street R. R. Co. (the Fourth Ave. line) to substitute electricity for horse-power.

——PIG-IRON PRODUCTION IN THE SOUTH, last year, was 1,005,000 tons. Of this, Alabama made 341,000 tons; Tennessee, 278,000 tons, and Virginia, 217,000 tons. This is an increase of 136,000 tons over 1887, while in the rest of the country the production of pig-iron was about 500 tons less than 1887. So says the *Manufacturers' Record*, of Baltimore.

——CHICAGO ELECTRIC LIGHT SUBWAYS work so well according to the report of Mr. I. P. BARRETT, City Electrician, that they "can hardly be improved", and 1,500 arc lights are supplied by the current passing through them. It seems a little queer that the New York experience has been so different. Perhaps if we had a more competent Board of Electrical Control, and more electrical experts and less place-holding, the result might be different here too.

——A MINNESOTA WATERWAY SCHEME is suggested in the annual report of the State Waterways Commission. The report recommends that steps be at once taken to investigate the practicability of establishing a waterway from the head of Lake Superior, through Rainy Lake river, Rainy Lake and Lake of the Woods to the Red River region. A joint commission of United States and British representatives is suggested.

——THE BUENOS AYRES, ENSENADA & SOUTH COAST Railway Co. has been incorporated to acquire that por-

tion of the Buenos Ayres Provincial Government railway from the Elizalde station, near the city of La Plata, to Magdalena, about 30 miles, with running powers to Pereyra on the Buenos Ayres & Ensenada Port Railway; also to extend the Magdalena line to the sea coast at Las Piedras, about 40 miles. The road will be practically an extension of the Buenos Ayres & Ensenada Port Ry., and is to develope Las Piedras as a seaside resort. EDWARD WOODS, of London, is the engineer.

——A DIAMOND AND GOLD SYNDICATE is the seductive title of a company alleged to be formed for developing diamond fields and gold mines in Brazil. The company claims it has a grant of 60,000 acres on the Upper Amazon river near the eastern foot of the Andes. And it may have all this and nothing else.

Stand-Pipe Formula; A Correction.

In answer to several correspondents we would say that in a short article on the thickness of plates for stand-pipes, in our issue of Dec. 15, occur two typographical errors caused by carelessness in replacing figures of a "wrong font", corrected in proof reading. As corrected the formulas there given should read as follows:

$$50 \times 2r\left(\frac{h}{2}\right)^2 = 144 \times 6000\,(r^4 - r'^4)\,\frac{.7854}{r}$$

whence $r^4 - r'^4 = \frac{h^2\, r^2}{27144}$

The figure "300" in the column of "height in feet" should read 200.—ED. ENG. NEWS].

CORRESPONDENCE.

The Presidential Contest in the American Society of Civil Engineers. A Card from Mr. Thos. C. Clarke.

No. 1 Broadway, NEW YORK, Jan. 9, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

I have received a letter from a member of the American Society of Civil Engineers, asking me to withdraw my name as candidate for the office of its President.

I shall not do so, and wish to publicly give my reason for this course.

I believe it to be for the best interests of the Society that there should be a contested election.

Some members holding this opinion issued a second ticket. Had they done so before Dec. 1, the Society would have, under Clause 25 of its by-laws, borne the expense. They preferred to do that themselves. If this be "irregularity"—let the most be made of it.

But the real point, which some members try to make is, that to vote for a second ticket casts a slur upon the first. If it were admitted that nobody could bring forward a second ticket, either under Clause 25, or otherwise, then it would follow that the Nominating Committee and not the Society itself elected the officers.

That is the strict logical consequence of members being not allowed to vote upon a second ticket.

As to the personal charges, I do not believe them, and shall not notice them.

There is no odium in not being elected. It simply means that more members prefer one man than others do. If it is Mr. BECKER, my heart will not be broken, and I hope he feels as I do.

A still more important reason why I do not withdraw is, that I hope this year's contested election will bring about the changes in mode of nominating candidates desired by many of our members. Your obedient servant,

THOMAS C. CLARKE.

[The views which Mr. CLARKE expresses are those which every right-feeling man must hold as to there being no reproach in not being elected, and we are pleased to learn that he agrees entirely with the views expressed in ENGINEERING NEWS of Jan. 5 as to the desirability of some change in the methods of nominating and electing candidates, so that there may be legitimate provision for contests and for a real expression of the will of the membership. But there is another view of the questions involved which does not seem to have occurred to Mr. CLARKE, discussed on our editorial page in an article written before receipt of his communication, and quite apart from the immediate issues involved, we cannot but feel that it sheds a somewhat different light upon the consequences of allowing members who "prefer to bear the expense themselves" to relieve the Society's pocket of a constitutional burden.—ED. ENG. NEWS.]

Wood Treatment Tests.

Carolina Oil and Creosote Co.

WILMINGTON, N. C., Dec. 17, 1888.

TO THE EDITOR OF ENGINEERING NEWS:

It is gratifying to observe that my previous letter on this subject has served to elicit some additional facts in regard to the tests published in your issue of Sept. 1, as evidenced by Mr. LOUIS FOCHT's communication in your issue of the 8th, inst., which appears to be offered as a reply to my inquiries: and Mr. FOCHT has my cordial thanks for his courtesy. Your types in the original article, however, seem to have improperly located him as the engineer of the creosoting works where the tests were made. Hence my overlooking him in writing to the Chief Engineer, who was reported as having had the tests made of the large railroad of which it now appears he is the Assistant Engineer. But I shall have no controversy with either of these estimable gentlemen.

It was thought that the process of treating timber for marine works by mere soaking had long since been discarded as ineffectual by all experimenters, and the results in this case are not, therefore, disappointing, as they are also not properly comparable. It is not all improbable, however, that the use of the wood creosote oil would have proven, in this instance, equally as effective as the dead oil under exactly similar conditions, and that entirely opposite results would have been reached, had all the conditions been just reversed.

Permit me to improve this opportunity for emerging from obscurity, by saying that since the appearance of my previous letter I have been engaged as the Engineer and Superintendent of the above named company, and will be pleased to respond, as far as I may be able, to inquiries from those who may be interested in the important question of wood preservation with which I may be honored. Yours truly, F. C. PRINDLE.

Hand Levels for Topography.

Norfolk & Western R. R.

TAZEWELL, Va., Dec. 17, 1888.

TO THE EDITOR OF ENGINEERING NEWS:

I enclose for your inspection a topographical scale such as you speak of on page 467 of your last issue. The same was used by me during my connection with Pittsburg, McKeesport and Youghiogheny R.R., some years ago and has seen considerable service, as you will observe. I have, however, abandoned the use of it entirely, and now take my contour altogether with a Locke level which I think is the preferable and most accurate not to say scientific method. Yours truly. EMILE LOW.

[There is something to be said for either method. There is no absolute best, with long regular slopes, angles are the best; with a much broken surface, the hand level, but probably more slopes are broken than regular.—ED. ENG. NEWS.]

A Simple Nut to Crack.

TO THE EDITOR OF ENGINEERING NEWS:

As "David" in your issue of Jan. 5, evidently considers his nut uncrackable, it might be well to tell him that as he has stated it, it is falsely stated, and if he had stated it properly it would have been indeterminate.

If from the ends of a base, perpendiculars of 60 and 90 ft. are erected and diagonals drawn from the bottom of each to the top of the other, they will always cross at 36 ft. from the base, and cannot possibly cross at 40 ft. as "David" says they do. And this distance of 36 ft. will be the same for any base you please. If David had stated the nut properly the answer would be "any base you choose." As it stands, his statement contradicts itself. The segments of the base under the point of crossing are always as 60 to 90. Time of solution 5 minutes. "David" should eat more celery and less turkey and oysters.

SOLOMON.

[That was probably the point of "David's" problem. By looking at the diagram again it will be seen that to fulfill it the base must be $\frac{3}{5} \div \frac{3}{5} = \frac{3}{5}$ of itself; yet we have received two or three geometric solutions which simply point out that he "introduces too many conditions" and need not have specified any particular length of base. The problem is too simple to be worth more discussion. ED. ENG. NEWS.]

Rational Column Formulæ.

CANTON, O., Jan. 1, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

The number of engineers who will use a purely rational formula which they can readily comprehend, in preference to an empirical expression based on limited experiment and foreign material, should vary inversely as they become thoroughly familiar with those experiments and are satisfied that the results have been correctly interpreted.

It is not surprising then, that you find many of the engineers who have to design metal structures *to-day*, and cannot find time to go through the foundation of LAUNHARDT'S, WEYRAUCH'S, or the straight line formulæ, etc., until *to-morrow*: looking shyly at the formulæ and wondering *which* will be generally accepted, or reluctantly using them as "the best we have in stock at present" because some one else has adopted them.

On page 310 of your Vol. 17, Mr. OTTEWELL proposes the formula, $a = u\left(1 + 2\,\frac{Min.\ B}{Max.\ B}\right)$ for members of structures subjected to constant and variable stresses of the same character, and in same volume on page 330, he gives his reasons for proposing it and seems most agreeably surprised when his reasoning deduces the formula so similar to LAUNHARDT'S.

It is not likely that any engineer will object to the *fundamental reasons* given farther than to differ in opinion as to the values assumed for safe stresses per unit of section.

The next step in order will be to examine the formula that is to symbolize those reasons.

Using the same notation as Mr. OTTEWELL.

Let $m = Min.\ B$ = least or constant stress on member.
Let $M = Max.\ B$ = greatest stress on same member.
Then $M - m$ = the variable stress on member.
Let t = assumed unit stress for dead or constant load.
Let u = assumed unit stress for live or variable load.
Let a = the safe unit stress desired.

Then $\frac{M}{a}$ = section of metal required.

The section of metal required by $m = \frac{m}{t}$ and that required by $M - m = \frac{M - m}{u}$

Then $\frac{M}{a} = \frac{m}{t} + \frac{M - m}{u}$ $\therefore a = \frac{u}{1 - \frac{t - u}{t}\left(\frac{m}{M}\right)}$ or

$$a = u\left(\frac{1}{1 - \left(\frac{t - u}{t}\right)\frac{Min.\ B}{Max.\ B}}\right)$$

The formula being quite different from that of Mr. OTTEWELL or Mr. LAUNHARDT.

The writer was quite surprised that it did not agree with the former, but not that it lacked identity with the latter, and will leave those who are familiar with the subject to judge whether Mr. LAUNHARDT or Mr. OTTEWELL resorted to "a mathematical dodge" to add weight to their formula or reason by mirror-like influence.

By assuming that the value of $t = 2u$, the formula

$$a = u\left(\frac{1}{1 - \frac{t + u}{t}\,\frac{Min.\ B}{Max.\ B}}\right)$$

reduces to

$$a = u\left(\frac{1}{1 - \frac{Min.\ B}{2\ Max.\ B}}\right) \quad \text{or} \quad \frac{t}{2 - \frac{Min.\ B}{Max.B}}$$

which gives value of a identical with those in use by many of our reliable engineers to day.

As it is purely rational, and so simple that any engineer can readily comprehend it, another quotation from Mr. OTTEWELL, Vol. 17, p. 376, may apply.

"On reason build resolve—
That column of true majesty in man!"

J. W. PEARL.

Elevated Railways as Carriers of Telegraph Wires.

MARIETTA, O., Dec. 27, 1888.

TO THE EDITOR OF ENGINEERING NEWS:

I am in New York quite often, and it has always been a surprise to me that there is no use made of the Elevated Railway except for the running of cars. Is it not possible to run telegraph and telephone wires say, immediately under the ties, the same to be imbedded in a superior non-conducting material? While aiding in solving the vexed question of what to do with your telegraph lines, it would also help very materially in deadening the sound of running trains and, if anything, make it more substantial and firm. It would also be suitable for attaching pneumatic tubes for carrying packages, etc. I should think the matter worthy of consideration, and would be pleased to see the same discussed, while in the future, I should be willing to give in detail plans that I had thought would make the same practicable. Respectfully,

F. S. SHURICK.

[There is merit in the suggestion of our correspondent, and while the elevated structures in New York have been utilized to some extent in this direction, there seems to be no valid reason why the system should not be much extended. We should be pleased to see the plans proposed by Mr. SHURICK, and doubt not that *many* objectionable lines of wires could be so disposed of in New York with most decided advantages. ED. ENG. NEWS.]

Reducing Valves.

January 5, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

We have a reservoir about 300 ft. altitude. Can the service for domestic use be reduced to a pressure of about 60 lbs. by any system of pressure valves, so that we

can have full pressure for fire purposes without breaking head by building second reservoir?

Yours very respectfully, E. D. B.

[Simply throttling the supply will answer the requirement of reducing the pressure. But automatic reducing valves are made by several manufacturing firms, and if they will kindly communicate with us, we will put them in touch with our correspondent. We do not know of any automatic valve that will increase the pressure for a fire demand where the volume required remains about the same. But a lower-level reservoir is unnecessary.—ED. ENG. NEWS].

Notes and Queries.

H. C. KEITH, of the N. Y. & N. E. R. R. Co., Boston, Mass., wishes to learn who is now in posession of the papers and memoranda of JAMES P. KIRKWOOD and ARCHIBALD KENNEDY.

I. L. LUDLOW, of Winston, N. C., wants to know who manufactures a residuum from coal-tar distillation paving cement.

A machine for making sheet-iron pipe, with spiral welded, riveted or other water-tight joint, is wanted by a California correspondent. Any maker of such machines, who can also sell them, will confer a favor by communicating the fact to this journal.

A Canadian engineer asks through our columns for the experience of engineers with pressed brick used for sewer construction.

BOOK NOTICES.

Practical Surveying: a Text-Book for Students preparing for Examinations or for Survey Work in the Colonies. By GEO. WM. USILL; A. M. Inst. C. E. London, Crosby, Lockwood & Co.; New York, D. Van Nostrand, 12 mo.; pp. 272, 4 plates, 330 cuts. $3.00.

This book adds another to quite a list of similar books on surveying which have appeared both here and in England in the past two or three years, and while there are some exceptions to be taken to parts of it, as notably the absurdly antiquated system of keeping level notes, which was abandoned here half a century ago in favor of a more rational system which does not seem to have been heard of yet in England, yet the book is certainly its own excuse for being, and has certain decided merits. We feel warranted in saying what we cannot always say, that every buyer interested in its subject matter will not regret its purchase.

Although it seems almost like a reflection on the substance of the book itself to speak first of its mechanical get-up, yet it is so decidedly superior in style and good taste to most of our American text-books, that we feel moved to do so. The binding and lettering thereon, size and shape of page, paper, cuts and selection of type, all are excellent, and all different from and better than the usual style of our American publishers of like publications. Why is it that, whereas our American publishers of purely literary books get them out in a mechanical style unsurpassed and hardly equalled in the world, so many of our American scientific publications are heavy, ugly, and badly put together generally? We will not pause for a reply, but simply note the fact, in hope that it may lead to improvement.

The first 28 pages of the work under discussion gives an excellent outline of the general principles of surveying, of nearly universal application, but indicating that Englishmen are much more leisurely about such works than Americans, as they are in some other things.

The next chapter, on instruments, describes several of very unfamiliar appearance, including one or two which it is little to our credit not to know better. This is especially true of a combined clinometer and hand-level on p. 35, which is a most excellent instrument, of which we think we shall have to give a view. The theodolite instead of the transit would seem to be still the standard English instrument, although the author says of an excessively gawky, clumsy and ridiculous looking transit on p. 55, which it would be hard to sell new for $20 in this country that "I would never use any other where accuracy and facility of work are important." If the author has such an opinion of such an instrument we have no doubt that if he once had a chance to see a good American transit he would not think the theodolite even worth illustrating. The very variety of instruments shown, shows the backward state of English practice in this respect. Survival of the fittest should have weeded out half of them, but we ought to know more than we do of half of the other half. The dumpy level is still stated to be "the most approved" in England, and with all the variety of instruments we notice that the gradienter screw, one of the best of modern innovations, is not even alluded to.

The chapter in geometry, trigonometry and logarithms is quite long (50 pages) and not particularly good, although it has its good points. Our American text books are rather in advance of the English in their form in these respects, we think. The substance is of course the same in each.

The next 37 pages are devoted to chain and angular surveying details, and may be read with profit by students. They are admirably illustrated. The next chapter on leveling we have already sufficiently characterized. It almost rises to the dignity of a national discredit that English engineers have not even in half a century learned better than to keep level notes in the fashion below, which we reproduce in full as an archæological curiosity for Americans; the kind of notes their grandfathers used to keep when the arts were young, and engineering was just born:

Back-sight	Fore-sight	Rise	Fall	Reduced levels	Remarks
4.10				20.00	Below A
	10.15		6.05	13.95	At B
5.30					
	8.19		2.89	11.06	At C
3.50					
	0.17	3.33		14.39	At D
7.18					
	0.30	6.88		21.27	At E
0.40					
	0.15			15.52	At F
20.48	24.96	10.21	14.69		
	20.48		10.21		
	4.48		4.48		

The advice not to put bench marks on the "top hook of the hanging post" of gates appropriately follows this precious example of the art how not to do it, which is the standard practice of English and continental engineers throughout the world to-day; unless some few of them have learned better in America. It is a singular example of obstinate, unreasoning conservatism. The English telescopic level rod, however, we consider a very good instrument, though somewhat clumsy.

Contouring is explained fairly well and then comes "setting out curves", to which we usually devote a separate hand book. English practice in this detail is well known to be so different from our own, and we may add so inferior, that we do not think it will be studied with any great profit. The following chapter on office work, however, is better, and has excellent points. The remarks on mapping are unexceptionable, and on land quantities good and of general application. The author apparently has not used the planimeter much, or he would not say of it that "it is a very delicate instrument and the slightest dirt or rust will throw it out of gear." According to our experience it stands ordinarily rough uses very well, and in this country at least it has practically driven out all the other methods given for computing irregular areas.

The general effect of the work is to make an American feel that we have little to learn from our transatlantic brethren in the practice of surveying, but that that little is worth learning and here attractively presented. On the other hand they in their turn have had for decades past not a little to learn from us, which they show little disposition to learn. With that we need not be concerned. Let us, like sensible men, learn what we can from them.

PUBLICATIONS RECEIVED.

Technology Quarterly.—Massachusetts Inst. Tech., Boston. "A Few Hints about Drainage", "On the 'Loss in Ignition' in Water Analysis", "Elastic Limit of Steel", Tests of Strength of Cast-Iron", etc.

Journal of the New England Water-Works Association.—The December number contains a paper on "The Safe Ratio of Pumping Capacity to Maximum Consumption", by WM. B. SHERMAN, and one on "Water Meter Tests", by L. FRED. RICE. Also discussions on water meter tests.

Selected Papers of the Rensselaer Society of Engineers. December, 1888.—"Theory of the Masonry Arch", WM. H. BURR; "Water Supply for a Small Town", KENNETH ALLEN; "A High Lift Canal Lock Proposed in 1879 for the Nicaragua Canal", ALBERT MILLER; "The Heating and Ventilating of Large Buildings", RICHARD PRESCOTT.

Transactions, Technical Society of the Pacific Coast.: November and December, 1888. Vol. V., No. 4. Contents: "The Swamp and Marsh Lands of California." By MARSDEN MANSON. "Experiments for Determining the Relative Tensile Strength of Iron and Steel." By Lieut. E. P. GILMORE. U. S. N. "Tables on the Tensile Strength of Iron and Steel."

Annual Report of the Commissioner of Dams and Reservoirs, State of Rhode Island and Providence Plantations. Pub. Doc. Plates CLXXXI to CCVI inclusive.

This unique and most valuable series of reports has covered the condition of no less than 429 dams in the single State of Rhode Island, being more than one for every 2½ sq. miles of its area. Included in this number are 60 which have become disused, but still exist. A large number of these dams have been previously reported as "of at least questionable stability", and of those so warned against, no less than 16 failed last year. The Commissioner is Mr. L. M. E. STONE, who has proved an exceptionally able and faithful incumbent of an office which might well exist in other States. There cannot be much water power in Rhode Island going to waste.

Annual Report upon the Improvement of Certain Rivers and Harbors in New Jersey, Pennsylvania and Delaware. In charge of Lieut. Col. HENRY M. ROBERT, U. S. Engrs. Pub. Doc. Pamph. pp. 78.

Hand-Book and Illustrated Catalogue of Engineers and Surveyors Instruments, made by Buff & Berger, Boston, Mass., 1889. Price 60 cents.

This is the latest catalogue of this well-known firm, and as in previous editions it is divided, in one part devoted to a description of their instruments and directions for use and adjustment, and in the second part a price list.

PERSONAL.

Col. E. S. LATIMER, President of the Wilmington & Seacoast road, has resigned.

Col. J. R. SHALER has been appointed General Manager of the Chattanooga, Rome & Columbus.

Mr. C. H. HUBBELL, Auditor of the Troy & Boston, has been appointed Acting Superintendent of the south-western division of the Chicago, Kansas & Nebraska.

Gen. SAMUEL THOMAS has been re-elected President of the East Tennessee, Virginia & Georgia Railroad Co.

Col. ALBERT JEWETT, Superintendent of the Seneca Falls & Waterloo Railroad, died at Waterloo, N. Y., Jan. 3.

Mr. I. Y. SAGE has been appointed Superintendent and Engineer of the Georgia Pacific division of the Richmond & Danville.

Mr. W. H. BRIMSON, Superintendent of the Duluth & Iron Range road, has resigned. Superintendent POPE, of Chicago, succeeds him.

Mr. J. VAN VECHTON, Master Mechanic of the Delaware Division of the New York, Lake Erie & Western, has resigned on account of ill health, and has been succeeded by Mr. WM. RANSOM.

Mr. E. S. BOWER has been appointed Acting General Manager of the Rome, Watertown & Ogdensburg during the absence of General Manager BRITTON; now in Europe for his health.

Mr. H. S. MITCHELL, chief clerk of the Kansas City, Fort Scott & Memphis system, has been appointed Division Superintendent of all lines north of Springfield, Mo., vice Mr. E. J. PERRY, assigned to other duties.

Mr. I. N. KALBAUGH, Master Mechanic of the Pittsburg Division of the Baltimore & Ohio, has been appointed Superintendent of Motive Power on the Trans-Ohio Division.

Mr. JOHN W. JOHNSTON has been elected Fourth Vice-President of the Richmond & Danville, with headquarters at Birmingham, Ala. He is to supervise and direct the extension of the new lines of the Georgia Pacific division.

Mr. J. W. CLOUD, Superintendent of Motive Power of the New York, Lake Erie & Western, at Buffalo, N. Y., has resigned. He will be succeeded by Mr. ROSS KELLS, Assistant Superintendent of Motive Power of the New York, Pennsylvania & Ohio, at Cleveland, O.

Mr. C. R. BARNHART, formerly Superintendent of the Louisville, Cincinnati & Lexington division of the L. & N., and more recently General Master of Transportation of the Georgia Central, has been made Master of Transportation of the Evansville & Terre Haute road, with headquarters at Evansville, Ind.

Mr. R. M. RICHARDSON, Master Mechanic of the St. Louis, Iron Mountain & Southern, has resigned, and has been succeeded by Mr. FRANK REARDON, of Denison, Tex., who has been Master Mechanic of the Missouri, Kansas & Texas for several years.

Mr. CHARLES M. HEALD, late Asst. Gen. Manager and Traffic Manager, Philadelphia & Reading R. R. Co., has been elected President of the Susquehanna Railroad Co. to succeed the late FREDERICK A. POTTS. Mr. SIMON BORG was also elected Second Vice President.

Mr JOHN W. ALVORD, late City Engineer of Lake View, Ill., has opened an office at 69 Ashland Block, Chicago, for the general practice of engineering, making a specialty of drainage, sewage disposal and water-works.

Mr. SAMUEL M. GRAY was unanimously elected City Engineer of Provinence, R. I., on Monday last. This is the eleventh year of his service as such. He was previously connected with the engineer's department of the water-works of that city for over six years, making a continuous service of over seventeen years. It is expected that the city will enter at once upon the work of building the improved sewerage. The plans consisting of marginal sewers, pumping station, and works for chemical precipitation have been adopted.

SOCIETY PROCEEDINGS.

American Society of Civil Engineers.—At the third meeting of St. Louis members of the Society held Jan. 2, 1889,

Vice-President ROBT. MOORE in the chair and 16 members present, it was resolved as the sense of the meeting that the most desirable place to hold the next annual Convention would be at some resort in the mountains of Virginia.

After some general discussion of the opposition ticket just sent out, it was moved by Mr. MEIER, that it is the sense of the meeting that we, the St. Louis members, will not lend our support to any anonymous movement. Unani-

mously carried, after a general debate. By count there were then 74 members present.

American Society of Civil Engineers.—The following circular in reference to the Opposition Ticket will have been issued to members before receipt of this issue.

The undersigned members recommend to your consideration the name of Mr. THOMAS C. CLARKE for President o the American Society of Civil Engineers.

Mr. CLARKE has been closely identified with the progress of our Society and has been its Vice-President.

His reputation as an Engineer is well known both in our country and abroad.

The charge made in the Pittsburg circular that our opposition is based solely upon the fact of the regular nominee being foreign born is denied. Our Society has already had five presidents who were born in Europe and upon the regular ticket now before you there are three foreign born members.

We believe the membership of our Society should have more of a voice in the selection of our officers than can be possible with only the accidental selection of the nominating committee, in the field.

A far better opportunity is given for determining the wishes of the majority by presenting the name of an additional candidate for the presidency of our Society.

In view of the invitation extended to us to meet the foreign Engineering Societies next summer in London and Paris, we think it perfectly proper and desirable for our young Society to be represented on this occasion by a President who is an American Engineer in every sense of the term. In expressing this desire and preference we do not in any manner, desire to reflect upon the regular candidate or to deny the important part taken by our foreign born members in the advancement of American Engineering.

You are earnestly requested to record a vote, that a true expression of the desire of the majority may be obtained. Your vote can be recalled and corrected any time previous to the closing of the ballot on January 16.

LEFFERTS L. BUCK	CHAS. H. MEYER
WM. H. BURR	WM. BARCLAY PARSONS
THEODORE COOPER	P. ALEX PETERSON
CHAS. G. DARRACH	ANDREW J. POST
JOSEPH P. DAVIS	ALEX. J. SWIFT
HOWARD N. ELMER	JOHN G. VAN HORNE
CHAS. E. EMERY	JOHN A. WILSON
FRANCIS V. GREENE	HENRY W. WILSON,
ALBERT B. HILL	&c.
HENRY G. MORRIS	

American Society of Civil Engineers.—Annual meeting, Jan. 16 and 17, 1889. The annual meeting of the Society will be held January 16 and 17, at the Society House.

Wednesday, Jan. 16.—The meeting will open at 10 o'clock, and will continue through the day. Lunch will be served at the Society House at 13.30 o'clock. During the meeting the annual reports will be presented; officers for the ensuing year elected; the awards of the Normal medal and of the Rowland prize for the past year announced; the place for the next convention considered; reports from various committees presented and discussed; technical subjects discussed; general business transacted.

Thursday, Jan. 17.—The arrangements for this day will be announced in detail at or soon before the meeting. They will include visits to a number of points of engineering interest. In the evening a reception for gentlemen will be held at the House of the Society, and at 21.30 oclock supper will be served.

CHARLES W. HUNT, *For the Committee.* JOHN BOGART, *Secretary*

Western Railway Club.—At the next meeting of this Chicago club, on January 15, Mr. J. H. SETCHEL, of Dunkirk, N. Y., will read a paper on "Continuous Steam Heat for Railway Trains, its Advantages Considered and Objections Removed"; Mr. W. L. JOHNSON, of Milwaukee, Wis., will read a paper on "The Essential Elements of Steam Heating." The subjects for discussion are "Heating cars by steam", and "Can there be an absolutely anti-frictional metal made for journal bearings to prevent the heating of same under ordinary circumstances?"

WALTER D. CROSMAN, *Secretary.*
Adams Express Building.

Illinois Society of Engineers and Surveyors.—The fourth annual meeting will be held at Bloomington, Ill., Jan. 23, 24, 25. The reports of the standing committees will be presented, and the following papers read: "Drainage Areas and their Drainage Discharge", C. G. ELLIOTT; "Railroad Engineering", E. A. HILL; "Progress of the Cairo Bridge", S. F. BALCOM; "Methods of Measuring and Computing Earthwork", E. L. MORSE; "The Metrical System", S. S. GREELY; "Levee Construction", E. J. CHAMBERLAIN; "A Topographical Survey", E. I. CHANTINE; "Bloomington, a Report to the Committee on Municipal Engineering", A. H. BELL, City Engineer; "Electric Lighting in Small Cities", JAS. H. GARRETT; "The Sources of the Water Supply of the City of Springfield", S. A. BULLARD; "Sources of Water Supply and their Development", D. W. MEAD, City Engineer, Rockford; "Specifications", W. D. CLARK; "Problems in Surveying", D. L. BRANCHER; "Sewage Disposal", A. N. TALBOT; "Assessments", H. A. STEVENS; "By What Rules of Law are Course, Distance and Area Governed, in the Subdivision of the Government Section?", Z. A. ENOS; "Geodetic Surveying", Prof. I. O. BAKER; "Surveying and Drainage", H. C. NILES; "A New Mexico Coal Mine", G. W. RICHARDS; "Mining Engineering Topics", A. C. BRANCHER; "The Use of Electricity in Mining", Prof. T. B. COMSTOCK; "The Causes of Railroad Accidents", S. F. BALCOM.

In addition to the papers there will be topical discussions; each topic has been sent to two or more members, who will give in reply their opinion, judgment, experience or custom. The subjects include superintendence of work, size of drainage pipe, riveted or pin-connected bridges, brick as a material for engineering construction, inspection of highway bridges, thickness of cover stones for box culverts, sewer ventilation, premium system for excellence in track work, etc. There will also be an exhibit and exchange of plans of engineering work of all kinds.

A. N. TALBOT, *Executive Secretary,*
Champaign, Ill.

National Electric Light Association.—The annual convention will be held at Chicago, Ill., on Feb. 19, 20, 21. ALLAN V. GARRETT, 16 East 23rd St., New York, is Secretary.

New England Water-Works Association.—An adjourned meeting will be held at Young's hotel, Boston, Mass., Jan. 16. The paper presented at the last meeting by WM. B. SHERMAN, on "What is the Safe Ratio of Pumping Capacity to Maximum Consumption", will be discussed. The paper has been printed in the December number of the Journal of the association and all members are invited to participate in the discussion. This discussion will be followed by a series of very brief papers, each of which will consist of a short statement of some personal experience or observation. HIRAM NEVONS, *President.* R. C. P. COGGESHALL, *Secretary.*
New Bedford, Mass.

Canadian Society of Civil Engineers.—The third annual meeting will be held in the Society's rooms at McGill College, Montreal, on Jan. 17.

HENRY T. BOVEY, *Secretary.*

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Long Island.—The four-mile extension from Locust Valley to Oyster Bay is not yet completed. Grading is nearly all finished, but the rails will probably not be laid until spring.

Rockaway Valley.—This New Jersey road, which was built last year from White House to New Germantown, 5 miles, is to be extended this season to Peapack, 5 miles farther. A scheme is also on foot to continue the line east through Mendham, Morristown, Whippany and Caldwell to a connection with the New York & Greenwood Lake road near Montclair. J. E. MELICK, White House, N. J., is Chief Engineer. It is stated also that the Greenwood Lake company contemplates undertaking the enterprise for its own benefit.

New York, Mahoning & Western.—At the annual meeting held in Findlay, O., Jan. 17, DAVIS JOHNSON, of New York City, was elected President; GEO. E. BLAINE, Dayton, O., Vice President; C. N. HASKELL, Findlay, O., General Manager.

Baltimore & Sparrow's Point.—Tracklaying has just been completed on this road, 7 miles in length, from Colgate Creek, near Baltimore, Md., to Sparrow's Point. RUFUS K. WOOD is Treasurer.

Toledo, Ann Arbor & North Michigan.—This company will build a bridge at East Saginaw, Mich., and is making surveys for an extension north from that point.

New York, Pennsylvania & Ohio.—The ninth annual report of the company refers to the double tracking of the Cleveland & Mahoning Valley Ry. for which $1,500,000 was raised. All but 10 miles of the double track has been built, but it has been so expensive that the remainder will not be built till required. The ballasting of the new line also remains to be done. About $225,000 has been expended for the purchase of steam hoisting machines for handling ore at the Cleveland docks, and $196,000 for the purchase of 20 locomotives. The report recommends that some of the heavy grades on the main line be cut down as soon as funds can be raised for the purpose.

Hereford.—Tracklaying on this road was finished Jan. 7. Through passenger trains will begin running in about a fortnight. Surveys are in progress for a line from West Stewartstown, P. Q., to the headwaters of the Connecticut river to tap large timber tracts.

Portland & Rochester.—A sharp controversy is in progress at Portland, Me., over the proposed extension of this company's tracks to the union depot. The extension will be an expensive one, but will probably be built.

Pennsylvania.—The company will during the present year complete the four tracking on the New York division, of which only a small portion remains to be done. The passenger station at Broad St., Philadelphia, is to be enlarged to better accomodate the rapidly growing suburban traffic. Work on the elevated tracks through Jersey City is also to be pushed.

New York & Ohio.—Engineers are setting grade stakes on this road between Aurora and Farmington, O., 17 miles, and the division is to be ready for the rails by June 1. The balance of the road to the Pennsylvania State line is to be finished by Oct. 1. Col. HORACE SCOTT, of Louisville, Ky., is interested.

Williamsport & Binghamton.—By the terms of their contract, Belden & McTighe, of New York City, the contractors for the road, are to complete the whole line from Williamsport, Pa., to Binghamton, N. Y., 110 miles, by Sept. 1, 1890. The line will run *via* Hillsgrove, Forksville and Towanda, Howe & Weed of Great Bend, Pa., have taken a sub-contract for 12 miles.

New York & Massachusetts.—Surveys are still in progress for the extension from Boston Corners east to Springfield, Mass.

Grand Rapids & Indiana.—This company has purchased the Big Rapids & Western logging road, owned by T. D. STINSON of Muskegon. The line is 13 miles in length. It is stated that it will be extened to Ludington next season.

Deer Creek & Susquehanna—At the stockholders' meeting on Jan. 8, at Belair, Md., GEORGE JEWETT was re-elected President and W. BEATTY HARLAN, Secretary. The contract with JOHN H. MILLER for the construction of the road was ratified and the issue of bonds to the amount of $300,000 was authorized. Negotiations are in progress between Mr. MILLER and L. B. McCabe & Bro. of Port Deposit, Md., and the firm will probably take a sub-contract for the work.

Bangor & Piscataquis.—At the directors' meeting held at Bangor, Me., on Jan. 5, it was voted to have surveys made at once for the extension from Oldtown to Bangor.

Baltimore & Drum Point.—This Maryland company has issued a prospectus in which it is stated that of the authorized capital stock of $1,500,000, $627,000 has been subscribed for. Of this the State and Anne Arundel and Calvert counties have taken $452,000, and private parties the remainder. The company is to issue bonds to the amount of $1,500,000 to provide funds for building and equipping the road.

Newfoundland.—The Government has called for tenders for the construction of about 250 miles of railway.

Projects and Surveys.

Evansville & Northern.—Incorporated in Indiana to build a road from Evansville, Ind., to Mount Carmel, Ill., connecting there with the Cairo, Vincennes & Chicago road. A construction company has been organized and $100,000 cash capital subscribed for the building of the road. Among the incorporators are JOHN KUSHN, WM. FIELD, T. R. MCPHERSON and ALLEN PERCY, of Evansville, Ind.

Coudersport, Hornellsville & Lackawanna.—The final survey of this Pennsylvania road has been completed and a very favorable route is said to have been secured. It is thought that the road will be built this year.

Mendham.—This projected New Jersey road, surveys for which were made last summer by the engineers of the Morris & Essex Co., is likely to be taken in hand by other parties. The company was organized with General Superintendent REASONER of the Morris & Essex branch of the Delaware, Lackawanna & Western Railroad as president, and it was promised that the road should be built at once. This has not been done and the people of Mendham think that the surveys were made and company organized by the above company for the purpose of discouraging others from undertaking the project and thus dividing the traffic, of which they at present hold the monopoly.

Sandusky, Ashland & Coshocton.—The citizens of Sandusky, O., are excited over a rumor that the Wheeling & Lake Erie Co. is to back this enterprise and will use the road to obtain an entrance to that city.

Louisville, Madison & Cincinnati.—The franchise and right of way of the Louisville, Cincinnati & Dayton, which runs from Hamilton to Middleton, O., a distance of 13 miles, has been purchased by this company, recently chartered at Madison, Ind. Among the incorporators are SIDNEY E. HAIGH and CHARLES A. KORBLEY of Madison.

Fort Plain, Johnstown & Saratoga.

FORT PLAIN, N. Y., Jan. 8, 1889.

EDITOR ENGINEERING NEWS:—This road is to run from Richfield Springs to Saratoga through Fort Plain, Ephratah, Johnstown and Gloversville, a distance of 67 miles. About 35 miles of this distance has been surveyed and the remainder of the location will be made as soon as stock is taken. There will be one long bridge. Nearly all the right of way has been secured between Fort Plain and Richfield and contracts will be let as soon as funds for construction can be raised.

WILLIAM CLARK.

North Attleboro & Wrentham.

NORTH ATTLEBORO, Mass., Jan. 8, 1889.

EDITOR ENGINEERING NEWS:—Some time ago we applied to the Railroad Commissioners of Massachusetts for a charter for our proposed road but were refused one. We have now petitioned the Massachusetts Legislature and are awaiting developments.

ARTHUR E. CODDING.

SOUTHERN—Existing Roads.

Kentucky Midland.—The first spikes on this road were driven on Jan. 4, at Frankfort, Ky., by the wife and daughter of the President, WILLIAM LINDSAY.

Tennessee Midland.—On Jan. 3 an excursion train carrying officers of the company and of the city of Jackson, Tenn., was run from Jackson east to the Henderson county line, a distance of 12 miles. By the terms of the subscription made by the city of Jackson, the company will now receive a subsidy of $125,000. It is expected that the track will be laid to Lexington, 28 miles east of Jackson, by Jan. 20.

Georgia Southern & Florida. — Ballasting is making rapid progress on the southern extension, and it is expected to have through trains running from Macon to Valdosta, 152 miles, by Jan. 20. Contracts are reported closed for the extension from Valdosta to Palatka, Fla., 135 miles.

Chowan & Southern.— According to the *Official Guide*, this road, which is under construction to be used jointly by the Richmond & Danville and the Atlantic Coast Line systems, to give them a terminus at Norfolk, Va., has been opened for business from Portsmouth to Beach Grove, 15 miles, from Tunis to Malander, 18 miles, and from Bruce to Pig Pig Point, 5 miles.

Roanoke & Southern.— About 20 miles of track are to be laid at once between Winston, N. C., and Martinsville, Va.; about 30 miles have been graded.

Louisville & Nashville.—The contract for grading a 3 mile branch from Pineville, Ky., to the mines of the Pine Mountain Iron & Coal Co. has been let to Nichols & Davison of Pineville, who are now at work on the grading. The 17 mile division of the Birmingham Mineral Ry., from Middle Springs to Oneonta, Ala., has been turned over to the operating department.

Dayton & Faunsdale.—King & Hannon of Selma, who are grading this 8 mile Alabama road, expect to complete it by April 1.

G orgia Pacific.—It is stated that a branch will be built from Greenville, Miss., to Huntington, Miss., where a ferry transfer will give connection with the Missouri Pacific system at Arkansas City.

West Rome Dummy.—JOHN J. SEAY of Rome, Ga., is building a short motor road to West Rome. Contracts for rails and cars are to be let at once.

Alabama Midland.—About 500 hands are now at work between Bainbridge, Ga., and the Chattahoochee river, and this division 35 miles in length, it is intended to have ready for the rails by Mar. 1. Work is then to be pushed on the division between Troy, Ala., and the river, about 70 miles. The company has purchased 17,000 tons of steel rails, 2 engines and 50 cars, R. A. Lytle & Co. of Bainbridge have the contract for the crossties. There will be two large iron bridges across the Flint and Chattahoochee rivers. ARTHUR POU of Bainbridge is Chief Engineer.

Chattanooga, Rome & Columbus.—The Atlanta *Constitution* describes in detail a reported project of President WILLIAMSON of this company to build up a great system in Georgia to compete with the Richmond Terminal. The lines to be built are from Carrolton to Columbus, Quincy, Fla., to Albany, Carrolton to Atlanta and to Selma, Ala., Griffin to Monticello and Sandersville, a total of 405 miles of which all but 200 miles would be built by outside companies. The project seems to still be in a very hazy condition.

Projects and Surveys.

Mussel Shoals, Elk & Tennessee River.— Incorporated in Alabama to build a railroad from the Mussel Shoals in the Tennessee river *via* Florence to Waterloo. The incorporators are CUTLER SMITH, W. P. RAGSDALE, J. W. FALK and others.

South Carolina.—The Legislature has passed bills incorporating the following companies: the Chester Street Ry. Co., the Orangeburg City Ry. Co., the Wilson & Summerville R. R. Co., the Cheraw & Barnwell R. R. Co.

Chattanooga Southern—It is reported that work is about to commence on this road. J. C. HENDERSON of Chattanooga, Tenn., is general manager.

THE NORTHWEST—Existing Roads.

St. Louis & Chicago.—On Jan. 7 Judge GRESHAM appointed ROBERT CAVETT, Receiver of this company, which has defaulted on the interest on $1,500,000 of its bonds. The line extends from Springfield to Mt. Olive, Ill., 62 miles.

Burlington, Cedar Rapids & Northern.—It is reported that a branch to Charles City, Ia., is contemplated. The towns along the proposed branch, which would be about 15 miles in length, will vote a 5 per cent. tax to aid the enterprise.

Chicago & Northwestern.—The city of Johnstown, Wis., has raised about $30,000 to induce some company to build a line through the town. An attempt is being made to induce the Chicago & Northwestern to build a line from Geneva to Janesville, *via* Delavan and Johnstown, about 25 miles.

Ohio & Mississippi. — Surveys are in progress for a long contemplated branch from Shawneetown, Ill., to a point on the Ohio river opposite Paducah, Ky.

Union Pacific. — The company has secured trackage rights for an entrance to Sioux City, Ia., over the line of the Chicago, St. Paul, Minneapolis & Omaha.

Canadian Pacific.—The surveying party under D. A. STEWART which has been locating the proposed extension of the Regina & Long Lake road, went as far as the Saskatchewan river. They found a very favorable route for the proposed extension.

St. Louis, Alton & Terre Haute.—A crossing war has been in progress at Alton, Ill., between this company and the Chicago & Alton over the extension of the company's line across the Alton's tracks. The difficulty was finally amicably adjusted. Both of the companies would have saved considerable outlay and benefited their stockholders if their managers had been less pugnacious and more business like.

Projects and Surveys.

Pacific Short Line.—This is the name adopted by the promoters for the proposed new transcontinental route, which is to run from Sioux City, Ia., to Salt Lake City, Utah, 930 miles, and on which considerable surveying has already been done under the charters of the Nebraska & Western, Wyoming & Eastern and Utah & Eastern companies. Subscription books have been opened at Sioux City and according to the press reports about $350,000 has been subscribed by citizens of that place. The road is to be built by the Wyoming Improvement Co. of 120 Broadway, New York City, and the Manhattan Trust Co., of New York will be trustee of the bonds. Who is to furnish the money to build this line in this section of the country is still problematical.

Grand Tower & Cape Girardeau.—Incorporated in Illinois to build a road by this name from Grand Tower to a point on the Mississippi River opposite to the City of Cape Girardeau, Mo. The incorporators are E. A. HITCHCOCK, St. Louis; THOMAS F. WHEELER, Cape Girardeau; W. W. BARR and J. D. PETERS of Carbondale, and B. D BROWNLEY of Grand Tower.

THE SOUTHWEST—Existing Roads

Kildare & Linden.—This 13 mile lumber road in Cass county, Tex., has been opened for general public traffic. J. H. BEMIS, of Jefferson, Tex., is President.

San Antonio & Aransas Pass.—Subscriptions are being secured for the proposed extension from Comfort, Tex., *via* Fredericksburgh to Llano, and nearly $100,000 has been raised. The terms offered by the company are that the subscriptions be sufficient to grade the road ready for the track.

Ultima Thule, Arkadelphia & Mississippi River.—This 11 mile lumber road in Arkansas has been opened for general traffic. G. W. HINE, Arkadelphia, Ark., is President and B. C. MONTGOMERY is Chief Engineer.

Batesville & Brinkley.—The directors of the White & Black River Valley Co., have elected JAS. P. COFFIN President, and W. L. MCDONALD, Secretary and Treasurer. The proposed line is to be an extension of the Batesville & Brinkley road.

Missouri Pacific.—This company is following the Atchison in the adoption of a retrenchment policy. A cut of 10 per cent. has been ordered in the salaries of all employés receiving over $100 per month, except enginemen and conductors.

St. Louis & Northwestern:

KIRKSVILLE, Mo., Jan. 3, 1889.

EDITOR ENGINEERING NEWS:

This road is to run from St. Louis to Omaha, a distance of about 500 miles. The Missouri division is to run *via* Monroe City, Shelbyville, Kirksville, Unionville, Leon, Seymour and Corydon. Surveys have been made over 220 miles of the distance. S. M. PICKLER of Kirksville is President. E. M. COLLINS, *Chief Engineer.*

Texas Grand Trunk.—Incorporated in Texas, by THOS. H. WILSON of New York, Gen. A. R. JOHNSON of Texas and others to build a railroad from the Sabine river near Hemphill, passing with its several branches through the counties of San Augustine, Nacogdoches, Houston, Burnett, Baudera, Zavalla, Travis and McLennan, a distance of 750 miles. The branches will connect with Austin, Burnett, Marble Falls, Eagle Pass, Waco and Lancaster.

Projects and Surveys.

New Orleans, Fort Jackson & Grand Isle. — This road is to run from Algiers, La., along the right bank of the river toward Fort Jackson, making Gov. WARMOTH'S plantation, 33 miles from Algiers, the first important station. The final terminus will be at the Quarantine station about 23 miles further on, making the total length of the road about 56 miles. Here it is proposed to build elevators and wharves to be at the disposal of vessels wishing to transfer their cargoes to the cars, by which it is claimed they can be distributed much quicker than if brought to the city by water. P. F. HERWIG of Grand Isle is interested.

Denison & Washita.— It is reported that funds have been obtained by the company, and the construction of this road will begin at once. At a recent meeting of the Directors the following officers were elected: President, W. B. MUNSON; Vice-President, E. PERRY; Secretary, H. V. PERRY; Treasurer, J. T. MUNSON.

Summit & College Mound.—Reorganized in Missouri to build a line of railroad, for which a charter was obtained in 1874, from Summit to College Mound, a distance of 12 miles. JOS. MORGAN is Presiden and C. J. DUBOIS, of Bevier, Mo., is Chief Engineer.

Central Belt Line.—Chartered in Missouri to build a narrow gauge road from Macon, Mo., to Bevier a distance of 6 miles. J. S. HUDSON is President and C. J. DUBOI of Bevier is Chief Engineer.

Nebraska, Kansas & Colorado.—Incorporated in Kansas to build a railway from Lenora, Morton county to Allison, Decatur county thence to Trinidad, Col., with a branch from Allison to the north line of the State, a total extent of about 300 miles. The directors are THOS. L. KIMBALL, Omaha, Acting Gen. Manager of the Union Pacific Co., DAVID D. HOAG, Kansas City, JOHN C. CASS, Allison, Kan., and others.

ROCKY MT. AND PAC.—Existing Roads.

Union Pacific.—A contract has been closed with the City Council of Cheyenne, Wyo., by which the company agrees to erect shops at that point to employ over 1,000 men.——A party of surveyors are at work on a line from Garrison to Missoula, Montana.——A half mile spur is being graded in Colorado to the Military post south of Denver.——The extensive surveys which are being pushed by the company in Northern California are causing much comment, and it is believed that the company must have made definite plans for an extension to the coast or so much would not be expended on the surveys.

San Francisco & San Joaquin Valley.—For nearly a year nothing has been done on this California road. The promoters of the enterprise are not discouraged however, and President WILBUR is now in the East trying to raise funds for construction.

Columbia & Puget Sound.—It is announced that a third rail will be laid on this narrow gauge road in Washington Territory and it will be extended to a junction with the Northern Pacific.

Rocky Fork & Cooke City.—The contract for the completion of this Montana road has been let to Green, Keefe & Co.; and the Billings *Gazette* states that they have already put a large force of men and teams at work.

Chicago, Burlington & Quincy.—According to the Denver *Republican*, about 100 hands are at work on the Grand river, near Newcastle, Col., making preparations to drive a tunnel about 1,000 ft. long through the range to reach some valuable coal mines in the Pinon basin.

Projects and Surveys.

Los Angeles Utah & Atlantic:—

LOS ANGELES, Cal., Dec. 31, 1888.

EDITOR ENGINEERING NEWS:—

The surveys for this road, which is to run from San Pedro Bay through Los Angeles to a connection with some southwestern line from Salt Lake, a distance of 500 miles, will begin about the first of January, 1889. The maximum grade of the valley line is 1½ per cent., maximum curve 5°; mountain work, maximum grade 2 per cent., maximum curve 8°. It is expected that tracklaying will begin some time between the 1st of April and the 1st of May, and that the first 30 miles of the road will be opened for traffic by July. The company was incorporated Nov. 31, 1888. J. M. C. MARBLE is President and CLARENCE W. SCOTT, Secretary. S.

Rio Grande & Utah.—The report which has been circulated that the contract for grading the first 10 miles of this road from Albuquerque, N. M., north, had been let to Corrigan & Lipe of Denver, is denied by the firm.

Calgary & Montana.—Chief Engineer W. D. BARCLAY has completed the preliminary survey for this road, from Lethbridge, N. W. Ter., to Fort Benton, Montana.

FOREIGN.

Ferro-carril Inter-oceanic de Mexico.—

CITY OF MEXICO, Dec. 24, 1888.

EDITOR ENGINEERING NEWS:—

The existing lines of this company on which trains are running, but on which repairs are being made, are from Mexico to Yautepec, from Mexico to Calpulalpam, and from Puebla to San Juan de los Llanos. Construction is now in progress between Vireyes and Perote, from Puebla to Namacamilpa, and from Yautepec to Amacusac. The line from Perote to Jalapa and Vera Cruz is now under survey and it is proposed to begin its construction at an early date. W. C. COPPERTHWAITE,
Engineer in Charge.

Mexican Central.—We have received from the President's office an additional statement of the construction on this road during 1888, showing in addition to that already given, 10.4 miles from mile post 105 on the Tampico division, making a total of construction for the year of 165.8 miles. The total extent of the system on Jan. 1, 1889, was 1,595.4 miles.

Mexican National.—The neat folder just issued by this company contains a map of Mexico of commendable execution and very fair accuracy, not at all like those usually put forth by general passenger agents. The line seems destined to be a popular one for the growing winter tourist travel.——The 60 mile line from Manzanillo, on the Pacific coast to Colima is under construction and will be completed early in the spring. Twenty-eight miles are now in operation. Surveys are in progress from Colima to Guadalajara and from Colima to a connection with the main line at Salvatierra.

Mexican International.—The State of Durango has granted the company right of way for a line from Torreon, the present southern terminus, to the city of Durango.

Yucatan.—The Government has granted several concessions for the construction of short local lines of railway.

Las Palomas Land Co. — This company, which is closely allied to the International Company of Lower California, has sold its franchise to a Chicago syndicate, according to report, which will begin work at once on the construction of the railway from Palomas, Mex., to Deming, N. M.

RAPID TRANSIT.

Electric Railways.—*Nashville, Tenn.*—The McGavock & Mt. Vernon Street Ry. Co. has made a contract with the Thomson-Houston Electric Co. for the equipment of a part of its road. The line has 2.30 miles of double track and .77 miles of single track; there are 7 curves and numerous grades, the maximum being 5½ per cent. The overhead system will be used, and there will be 6 cars, 16 ft. long, with capacity for 75 passengers; each car will be equipped with two 10 H. P. motors. On this division 8 horse cars are now used. The running time will be reduced from 70 to 30 minutes. The City Council has granted the right to all the street railway companies to adopt electric traction.

Southington, Conn.—The Thomson-Houston Electric Co. is equipping two miles of single track road. The overhead system is used, with the bracket method of suspension, except at curves, where the cross suspension is employed. The cars will be equipped with two 10 H. P. motors.

The Port Chester, White Plains & Tarrytown Surface Ry. Co. has secured the franchise for a street railway in White Plains, N. Y., from the N. Y. & Harlem Ry. depot to Elmsford, near the village limits. The company agrees to pay ⅛ of 1 per cent. of its gross earnings. It is intended to eventually extend the road to run from Tarrytown to Port Chester, passing through White Plains; the remainder of the route will be sold later. Work is to be commenced as soon as the weather permits.

Street Railways.—*Jefferson, Tex.*—The Lone Star Street Ry. Co. will build a line 3 miles long. President, W. E. HAYWARD; Secretary, DOUGLASS C. WISE.

Bexar, Tex.—The Bexar Street Ry. Co. has been incorporated, with a capital stock of $100,000, by J. L. LOCKWOOD and others.

Dummy Lines.—At Little Rock, Ark., the dummy line owned by the City Electric Street Ry. Co., of which HOWARD ADAMS is President, will be extended 4 or 5 miles this spring.——A dummy line will be built from Dardanelle, Ark., to Mount Nebo, by Capt. EVANS, of Dardanelle.

The Kings County Elevated Ry. Co., of Brooklyn, N. Y., received subscriptions this week for $1,500,000 of the first mortgage 5 per cent. bonds, the unsold balance of a total issue of $3,300,000. The bonds are a first mortgage on the 6 miles of road now completed and in operation, and on the rolling stock, franchises, etc. The mortgage is at the rate of $550,000 per mile, as against $800,000 or $900,000 per mile of bonds on the New York roads.

CONTRACTING

Pier Work.—The contract for pier construction at Ludington harbor, Mich., has been awarded by Lieut. Jos. E. KUHN, U. S. Engineer Office, Grand Rapids, Mich., to Truman & Cooper, of Manitowoc, Wis., at the following prices: *Cribs* (17); foundation and sheet piles, 60 and 30 cts. per lin. ft.; oak, hemlock and pine timber, $40, $14 and $30 per M.; pine plank, $15 per M.; screw and washer bolts, 4 cts. per lb.; drift bolts and straps, 3 cts.; spikes, 4 cts.; stone, $6.50 per cord; brush, $4 per cord; dredging foundation, 30 cts. per cu. yd.; total, $52,417.97. *Pile Pier*; Norway piles, 12 cts. per lin. ft.; pine timber and plank, $20 and $15 per M.; drift bolts and spikes, 3 cts. and 4 cts. per lb.; stone and brush, $6.50 and $3.50 per cord; total, $3,150.19. Total contract price, $55,568.16. The other bidders were Knapp & Gillen, Racine, Wis., $64,232.32; Hiero B. Herr & Co., Chicago, Ill., $68,182.12; Wm. E. Cook, Ludington, Mich., $72,584.89; Weimer, Rath & Gaylord, Ludington, $73,420.89; Wm. T. Casgrain, Chicago, $74,563.31.

The following proposals have been received by the Docks Commissioners, New York City, for repairing Pier No. 2, East River: O'Connell & Coffey, $7,995; Colin McLean, $9,900; B. S. Cronin, $9,940; John W. Flaherty, $12,500; Joseph Walsh, $12,500. The contract was awarded to O'Connell & Coffey.

Jetties.—The following proposals were opened Jan. 3 by Lieut. G. J. FIEBEGER, U. S. Engineer Office, Norfolk, Va: Jas. H. Cline and David R. Isaac, Richmond, Va.; wattle jetty, 76 cts. per lin. ft.; timber jetty, $2.70 per lin. ft.; mattress protection, 57 cts. per lin. ft.; total, $4,183.90. Myron J. Wheeler, Richmond, Va.; 95 cts., $2.47, 75 cts., $4,342.50.

Stern Dock.—The contract for an adjustable stern dock for the Key West navy yard has been awarded by the Navy Department to the only bidder, the International Bow & Stern Dock Co., of New Jersey, at $30,000.

Dredging.—*Mosquito Creek.*—The following proposals for dredging and removing material, 45,000 cu. yds. to be deposited on the marsh, 2,500 cu. yds. towed less than 2 miles, 2,600 towed between 2 and 4 miles, 2,000 towed between 4 and 6 miles, have been received by Capt. F. V. ABBOT, U. S. Engineer Office, Charleston, S. C.: Chas. C. Ely, 35, 36, 38 and 40 cts., $18,438; Louis S. Ehrich, 63 cts., $32,823; Samuel W. Skinner, 57 cts., $34,907; Alabama Dredging & Jetty Co., 72 cts., $37,512. The contract was awarded to Chas. C. Ely.

Portage Lake Harbor.—The following proposals for dredging 60,000 cu. yds. in the harbor of refuge have been received by Lieut. Jos. S. KUHN, U. S. Engineer Office, Grand Rapids, Mich.: Truman & Cooper, Manitowoc, Wis., 10 cts., $6,000; White & Finch, Grand Haven, Mich., 11¾ cts., $7,050; C. H. Starke, Milwaukee, Wis., 11.9, $7,140; S. O. Dixon, Racine, Wis., 15 cts., $9,000; Wm. T. Casgrain, Chicago, 20 cts., $12,000.

Cape Fear River.—The following proposals were opened Jan. 5 by Capt. W. H. BIXBY, U. S. Engineer Office, Wilmington, N. C.: Atlas Dredging Co., Wilmington, Del., 12¼ cts. per cu. yd. for $123,000 worth of work and 12 cts. per cu. yd. for additional $62,000 worth; Alabama Dredging & Jetty Co., Mobile, Ala., 12⅝ cts., and 12⅝ cts.; National Dredging Co., Wilmington, Del., 12.9 cts. and 12.9 cts.; P. Sanford Ross, Jersey City, N. J., 14 cts. and 13 cts.; American Dredging Co., Philadelphia, Pa., 14¾ cts. and 13¾ cts. The contract was awarded to the Atlas Dredging Co.

Pipe.—*New Castle, Ind.*—The following proposals have been received by the Water Commissioners: Snyder & Williams, $24.15 per ton for all sizes, $42.50 for special castings, $9,445.50; Addyston Pipe & Steel Co., $24.15 for pipe, $42.50 for specials, $9,445.50; New York Pipe Mfg. Co. (cement lined pipe, per ft.), 33 cts. for 4-in., 44 cts. for 6-in. 61 cts. for 8-in., 80 cts. for 10-in., $1.10 for 12-in., castings free, $9,465.90; Lake Shore Foundry, $25.40 per ton for pipe, $45 for specials, $9,938; R. D. Wood & Co., $25.65 for pipe, $50 for specials, $10,090.50; Detroit Pipe & Foundry Co., $26.50 for pipe, $45 for specials, $10,345; National Pipe & Foundry Works, $26.70 for pipe, $50 for specials, $10,479; Jno. Maxwell, $27 for pipe, $60 for specials, $10,784; Dennis Long & Co., $27.50 for pipe, $55 for specials, $10,835; Mellert Foundry & Machine Co., $30.20 for 4-in., $28.80 for 6 and 8-in., $28.40 for 10 and 12-in., $50 for specials, $11,228; J. J. Fisher, $31.70 for 4-in., $30.70 for 6 and 8-in., $30.20 for 10 and 12-in., $50 for specials, $11,888.50.——The contract was awarded to the Addyston Pipe & Steel Co.

Philadelphia, Pa.—The following contracts for cast-iron pipe for the Bureau of Gas have been awarded: Camden Iron Works, 11⅞ cts., 10.06 cts. and 35 cts. per ft. for 2-in., 4-in. and 6-in. Donaldson Iron Co., 15.18 cts. per ft. for 3-in. Mellert Fdry. & Mach. Co., 85 cts. per ft. for 12-in. Gloucester Iron Works, $1.60 per ft. for 20-in.

Stone.—The following proposals for furnishing about 25,000 cu. ft. of granite dimension stone at the Cascade locks, Oregon, for the improvement of the Columbia river, were opened Dec. 20 by Major THOS. H. HANDBURY, U. S. Engineer Office, Portland, Ore.: Frederick J. Carrol, Spokane Falls, Wash. Ty., $1.35 per cu. yd.; Miles C. Moore, Walla Walla, Wash. Ty., $1.95; W. W. Blanchard, San Jose, Cal., $2.10; M. J. Healy & Co., Pino, Cal., $2.50.

The following proposals for 2,000 cu. yds. of rip-rap stone have been received by the Docks Commissioners, New York City; Brown & Fleming, 74 cts. and 82 cts. per cu. yd.; John A. Bouker, 80 cts.

Spikes.—The following proposals for 12,000 lbs. of wrought-iron spikes have been received by the Docks Commissioners, New York City: H. A. Rogers, 2.4 cts. per lb. for 10x7-16-in., 2.25 cts. per lb. for 18x¾-in.; John Fox, 2.5 and 2.3 cts.; Adolph Stark, 2.6 and 2.3 cts.; Patterson Bros., 2.45 and 2.30 cts.; Alexander Pollock, 2.45 and 2.25 cts.

PROPOSALS OPEN.

Pipe.—Supply for the Water Department for 1889. THE WATER COMMITTEE, Allegheny, Pa.

Railway.—Construction of the extension of the Louisville Southern Ry. from Lawrenceburg to Lexington, Ky. Particulars to be obtained at the office of the Chief Engineer, at Louisville. HARRY WEISSINGER, President, Southern Contract Co., Louisville, Ky. January 14.

Street Work.—Excavation, filling, paving, curbing, flagging, 12-in. and 18-in. vitrified pipe sewer, 7 basins Also hauling stone. MARTIN FINCK, Clerk Board of Public Works, Jersey City, N. J. January 14.

Electric Lighting.—Street lighting, 30 arc lights of 2,000 c. p., or incandescent lights not less than 16 c. p., aggregating 5,000 c. p. FRANK BENTZ, Town Clerk, Ashland, Pa. January 15.

Street Improvement.—GEO. H. SIMPSON, City Engineer, Terre Haute, Ind. January 15.

Water-Works.—At Bellefontaine, O. Two duplex compound direct-acting engines of 750,000 galls. capacity each, 2 return tubular boilers, sheet-iron stack, brick pumping station, 127½ net tons (3,400 ft.) of 12-in. cast-iron pipe, 6,430 lbs. of special castings, pipe laying, etc. JOHN W. HILL, Cincinnati O., Consulting Engineer. THE TRUSTEES OF WATER-WORKS, Bellefontaine, O. January, 17.

Pier Work.—Repairing Pier 2, East river; repairing outer end of Pier 43, Barrow St., North river. THE DOCKS COMMISSIONERS, Pier A, North river, New York City. January 18, 22.

Bridge and Culverts.—One wooden bridge; 2 stone culverts. FRANK J. O'FLAHERTY, County Surveyor, Kansas City, Mo. January 19.

Building.—New Upper Canada College. GEO. W. ROSS, Minister of Education, Toronto, Ont., Canada. January 23.

Excavation and Wall.—At Auburn, Me. About 42,000 cu. yds. of earth and 2,900 cu. yds. of ledge; also construction of river wall. The FRANKLIN CO., Lewiston, Me. February 1.

GOVERNMENT WORK.

Scows.—Building 4 scows. Col. WM. P. CRAIGHILL, U. S. Engineer Office, Richmond, Va. January 15.

Water Supply and Sewerage.—Materials for completion of systems at Fort Robinson, Neb. Major WM. B. HUGHES, U. S. A. Quartermaster's Office, Omaha, Neb. January 15.

Submarine Torpedo Boat.—Extension of time. WM. C. WHITNEY, Secretary of the Navy, Washington, D. C. January 25.

Dredging.—Capt. W. M. BLACK, U. S. Engineer Office, St. Augustine, Fla. January 28.

MANUFACTURING & TECHNICAL.

Machine Tools.—The Universal Radial Drill Co., of Cincinnati, O., is making the largest radial drill ever built. It is 15 ft. high, 9 ft. radius, and 8 ft. under the spindle, which is 4 ins. diameter. All the gearing is of steel. The machine will weigh 15 tons and is for the Cramp Shipbuilding & Engineering Co., of Philadelphia.

Manning, Maxwell & Moore, of New York, have the contract for all the tools for the new Louisville & Nashville machine shops at Decatur, Ala.

The Rome Foundry & Machine Works, of Rome, Ga., are in the market for one second-hand planer, 32-in. x 32-in. x 7 ft.; one new shafting lathe 20-in. x 20 ft. between centers, with shafting turning attachment; one new lathe 24-in. swing by 8 ft. between centers; one suspension drill press; one foundry blower suitable size to melt 4 tons per hour; one forge blower suitable size to run two or three forges. Also want prices on metal roofing.

Brick, Tile and Sewer Pipe Machinery is wanted by the Hamil Brick Co.; the Sword brick making machine will be used. Address, A. J. Hamil, Americus, Ga.

Pump.—A deep well pump is wanted by D. W. DAY, City Clerk, Hartselle, Ala.

Cross Ties.—There are 50,000 ties wanted for the Lynchburg & Durham Ry. Address PETER J. OTEY, President, Lynchburg, Va.

Snow Ploughs.—The Vulcan Iron Works, of Chicago, have an order from Minneapolis parties for a rotary, steam, railway snow plough, fitted with Caldwell's patent auger. It will be the largest of its kind yet built, having double engines with 18 x 16-in. cylinders, and a locomotive boiler with 1,500 sq. ft. of heating surface; the total weight will be 55 tons. The car will be of structural iron, with trucks of special heavy design.

A Leslie patent rotary snow plough has been built for the Winona & St. Peter road, and has been stationed at Tracy, Minn.

Steel Ties.—The steel ties on the "Hartford" system, which have been ordered by the New York Central railway, will be rolled by the Joliet Steel Works, of Joliet, Ill.

Railway Supplies Wanted.—D. E. Cooper, of Gainesville, Fla., will build a standard gauge logging road 3 miles long; wants to use 60 lb. steel rails.

W. F. Parker, of Westminster, S. C., will build a lumber road 8 miles long, and will purchase engines, cars, machinery, etc.

Sims & Barnett, of Washington, Ga., will lay track to their brick yards, and will purchase dump cars, turn-table and wood working machinery.

Locomotives.—The Lima Machine Works, Lima, O., have shipped a "Shay" locomotive for steep grades to the Salt Lake & Fort Douglas Ry., of Utah.

The Cooke Locomotive Works, Paterson, N. J., are building 10 engines for the Chesapeake & Ohio; a number of eight-wheel and mogul engines have been built for the Chicago, Burlington & Quincy.

The Rhode Island Locomotive Works, Providence, R. I., have an order for 25 engines for the Union Pacific.

The Canadian Locomotive Works, Kingston, Ont., have completed 14 eight-wheel engines for the International Ry.; cylinders, 18 x 24 ins., drivers 62 ins., 99,750 lbs. total weight, 63,200 lbs. on drivers. There are now in hand 20 mogul engines for the Canadian Pacific; cylinders, 18 x 24 ins., drivers 57 ins., 98,000 lbs total weight, with 14,000 lbs. on the pony truck; boiler pressure 175 lbs. The engines were designed by Mr. F. R. F. BROWN, of the C. P. Ry.

The Oregon Ry. & Navigation Co. has ordered 5 ten-wheel engines for its mountain division.

The Chesapeake & Ohio will place orders for ten more engines.

The Warren Iron Co., of Goodrich, Tenn., will purchase a small engine at once.

Marine Engines.—The Navy Department, Washington, D. C., is advertising for proposals for constructing and furnishing the machinery, including engines, boilers, screws, shafting and appurtenances for the armored cruiser "Maine", which proposals will be opened Feb. 15. Evidence must be given by the bidders that they will have the necessary plant for the work within 3 months from the date of contract. The bids may be in 3 classes: 1, in accordance with plans and specifications provided by the department; 2, in accordance with these plans and specifications but with modifications by the bidder; 3, in accordance with plans and specifications submitted by the bidder.

A Turntable, 60 ft. long, has been built at Sebago Lake, Me., for the Portland & Ogdensburg, by the Union Bridge Co.

The National Water Purifying Co., of New York, reports many orders at St. Louis, Mo., and is altering to its National system the filter plant in the Southern hotel of that city. It has also orders for 2 town plants in Missouri, besides several orders to enlarge city filter plants which have been in operation for some time.

The Baldwin Locomotive Works, of Philadelphia, Pa., turned out 736 locomotives during 1888, beating the record of its annual output. Of this number, 188 were American type and other eight-wheel engines, 277 moguls and ten-wheel engines, and 269 consolidations. The orders included 60 engines for the Philadelphia & Reading, 50 for the Pennsylvania, 5 for Brazil and 30 for the Argentine Republic. The proportion of heavy engines was considerably increased. The works have a large number of orders on hand, and it is reported that they have taken the contract for 30 more engines for the Argentine Republic.

Steam Heating for Cars.—The Martin system has been adopted on the Elmira, Cortland & Northern.——The Delaware & Hudson Canal Co. has adopted a steam heating system on its Pennsylvania division, between Wilkesbarre, Pa., and Rouse's Point, N. Y.——The Boston & Maine has now a steam heated train running between Boston and Manchester, N. H.——The Cleveland, Columbus, Cincinnati & Indianapolis road is having success with its steam heating system.——The Chicago & Northwestern and the Chicago, St. Paul, Minneapolis & Omaha railways are using steam heat for their passenger cars.——The Pennsylvania R. R. has made a contract with the Martin Anti-Fire Car Heating Co., of Dunkirk, N. Y., for equipping the rolling stock on the Northern Central road.

Wooden Water-Pipe.—The Michigan Pipe Co., of Bay City Mich., has extensive works equipped with improved machinery, including large boring apparatus, with hollow augers ranging from 2 to 16 ins. diameter, the core from the larger pipes being re-bored for smaller pipes; also powerful turning lathes and machines for banding, testing and mortising pipe. The pipe is made in sections about 8 ft. long, from white pine logs first bored with an auger. The bark and sap wood being removed by a turning lathe, the pipe is placed in a drying room, whence it is taken after being properly seasoned, and bound spirally with hoop iron, pressed on tightly by steam power, the chambers of the joints made stronger than any other part of the pipe. Before being applied the iron is coated with soft asphaltum. The joints are then made; the thimble or connecting piece, 8 ins. long, is of seasoned timber about ¼-in. larger in diameter than the mortise of the pipe, so that it must be compressed when the sections are driven together, making a perfectly tight joint without packing of any kind. It is then subjected to a hydraulic pressure of 250 lbs. per sq. in., after which the pipe is given a heavy coat of asphaltum cement, to prevent corrosive substances from affecting the bands, and the work is completed. For connecting lines of pipe at street crossings, or hydrant pipes with mains, special castings are made to form a perfect joint. The annual product averages 100 miles of pipe, in which 600 tons of hoop iron are used. The company also undertakes the construction of water-works by contract, supplying pumping plant and all appliances for complete system.

Car Notes.—The Milton Car Works, Milton, Pa., are building 500 box cars and 500 coal cars for the Central of New Jersey.

The Youngstown Car Co., of Youngstown, O., is building 300 coke cars for the Schoonmaker Coke Co.

The Indianapolis Car Works, Indianapolis, Ind., have an order for 2,000 box cars for the Chicago, Burlington & Quincy; they are 34 ft. long, 60,000 lbs. capacity, and equipped with air brakes. The first lot of 100 has been delivered, and the works are delivering the rest at the rate of 125 per week.

The Peninsular Car Co., of Detroit, Mich., has turned out 25 standard gauge cabooses for the Denver & Rio Grande. An order is now in hand for 350 box, 450 coal and 300 stock cars for the Union Pacific.

The Michigan Car Co., of Detroit, Mich., has an order for 650 box and 250 Wickes refrigerator cars for the Union Pacific. The latter will be fitted with Westinghouse brakes and steel axles, and will be used for transcontinental business; 50 of them will be fitted with the Miller coupler and platform to allow of their being run in passenger trains for the fruit business.

The Litchfield Car Works, of Litchfield, Ill., have an order for 100 refrigerator cars for the Cincinnati, New Orleans & Texas Pacific.

The Wells & French Co., of Chicago, Ill., has orders for 150 coal cars for the Union Pacific and 150 box cars for the Kansas City, Fort Scott & Memphis.

The Pullman Car Co., of Chicago, is building 150 box cars for the Kansas City, Fort Scott & Memphis.

The Oregon Ry. & Navigation Co. has placed an order for 600 box cars.

The Cincinnati, Hamilton & Dayton is in the market for 300 box cars, and 100 stock cars.

The New York, Philadelphia & Norfolk will increase its rolling stock.

BRIDGES AND CANALS.

Bridge Notes.—*Newark, N. J.*—The new Hackensack river drawbridge for the Newark & New York Ry. has been completed. The draw is operated by steam.

Pittsburg, Pa.—The Pennsylvania Railroad proposes to build a new bridge over the Allegheny river at a cost of $750,000.

Lovely Mount, Va.—The Radford Land Impt. Co. has awarded the contract for a 400 ft. bridge to Geo. T. Mills, at $2,800.

Litchfield, Ky.—An iron bridge across Rough creek will be built by the authorities of Grayson and Breckenridge counties at a cost of about $6,000. Address G. H. GARDNER.

Fayetteville, N. C.—The Cape Fear & Yadkin Valley Ry. Co.'s new bridge over the Cape Fear river, for its Wilmington extension, will cost $100,000.

Asheville, N. C.—E. G. CARRIER is interested in a project to build a bridge to connect Asheville and West Asheville. It will be about 300 to 350 ft. long. A charter has been applied for.

Newark, O.—The contract for the East Main St. bridge across the north fork of Licking river has been awarded to Lane Bros. Bridge & Construction Co., at $8,000. It will be an iron deck bridge, 50 ft. wide, with an 8 ft. walk on each side, and a street car track in the middle.

Chicago, Ill.—Fitzsimmons & Connel have the contract for a double roadway steam drawbridge at Clark St. It will cost $150,000 and is to be completed by July.

Steven's Point, Wis.—The Wisconsin Central Ry. is building an iron bridge across the river. It will cost $25,000.

Topeka, Kan.—A stone bridge, 1,200 ft. long and 80 ft wide is to be built across the Kansas river, at a cost of $300,000.

Kansas City, Kan.—An ordinance has been adopted giving the mayor and council power to issue bonds for an amount not exceeding $20,000 for the construction of bridges and viaducts.

Little Rock, Ark.—County Judge HILL will build an iron bridge over Fourche Bayou, near this city.

Columbus, Neb.—The contract for a highway bridge over the Platte river has been awarded to M. Wagner, of Columbus, the lowest of 14 bidders. There will be 42 spans of 14 ft. each. The contract price is $44.7 per ft.

Sonoma, Cal.—The County Supervisors have let contracts for bridges across Russian river and Sonoma creek, to the King Iron Bridge & Mfg. Co., of Cleveland, O., at $20,350 and $3,675.

Laredo, Tex.—The first set of iron cylinders for the piers for the highway and street railway bridge were put in place Jan. 2. There will be 5 piers, the bridge having 6 spans of 150 ft. The track will be laid with a 25 lb. steel rail.

New York State Bridges.—The following proposals were opened Jan. 3, by the Superintendent of Public Works, Albany, N. Y.: Iron bridge at Frankfort; Groton Bridge Co., Groton, N. Y., $2,294; Shepard & Son, Havana, N. Y., $2,403; Rochester Bridge & Iron Works, $2,594; King Iron Bridge & Mfg. Co., Cleveland, O., $3,185. Iron swing bridge at Ithaca; Shepard & Son, $2,271; Rochester Bridge & Iron Works, $2,550; Groton Bridge Co., $2,795; Hilton Bridge Co., Albany, $2,800; King Iron Bridge & Mfg. Co., $2,958. Lift bridge at Rochester; Hilton Bridge Co., $20,900; Rochester Bridge & Iron Works, $21,640; King Iron Bridge & Mfg. Co., $26,900. The contracts were awarded to the lowest bidders.

Canal Notes.—The Augusta canal, at Augusta, Ga., has been completed and water turned on.

The Dismal Swamp Canal, in Virginia, has been purchased by W. H. PETERS, of Norfolk, Va., for $43,000.

The Cape Cod Ship Canal, at Sandwich, Mass., has advanced another mile. One dredge is at work. The canal will be 200 ft. wide on top, 75 ft. wide at bottom, 25 ft. deep at low water. No locks.

The Missouri, Aberdeen & Eastern Canal Co., of Aberdeen, Dak., will apply to Congress for an appropriation. The surveys will commence Feb. 1. Faulk Co. has offered $20,000 and right of way. President, S. V. ARNOLD, Roscoe; Vice President, J. BLACKMAN, Chicago; Secretary, M. HAWKINS, Aberdeen; Engineer, W. P. BUTLER, Aberdeen.

New York State Canals.—It is reported that the Canal Board has released Geo. M. Taylor, of Medina, from carrying out his contract for deepening old Orchard creek to properly drain the Tonawanda swamps. The work has been in progress over a year, and the State owes Taylor $14,000. The Superintendent of Public Works will finish the work.——The new bill is to provide for $1,000,000, to be expended before the opening of navigation in 1890; $550,000 for the Erie canal; $350,000 for lengthening 5 locks west and 9 locks east of Syracuse, and $200,000 for deepening said canals; $200,000 for deepening the Champlain canal; $75,000 for the Glens Falls feeder; $100,000 to improve the Oswego canal, for lock lengthening and deepening the channel of the Oswego ditch; $25,000 for improving the Cayuga and Seneca canal; $50,000 for the Black River canal, and $15,000 for improving the channel of the Oneida lake outlet. The money is to be reappropriated to dredge the lake level of the Chemung canal and for building a basin at Havana.

WATER AND MUNICIPAL.

Sewerage System.—At Tonawanda, N. Y., a system of sewerage is to be put in. No plan has yet been decided upon and engineers and others are invited to submit plans or to correspond with the authorities as to the merits of the different systems. FAYETTE A. BALLARD, Village Clerk.

New Castle, Ind.—Contracts have been awarded as follows by the Water-Works Commissioners: Pumping engines, boilers, valves and hydrants, Holly Mfg. Co., Lockport, N. Y., $5,500; pipe, Addyston Pipe & Steel Co., Cincinnati, O., $24.15 per ton; pipe laying, John Maxwell, Washington, Mo., at 16, 17, 21, 24 and 27 cts. per lin. ft. for 4, 6, 8, 10 and 12-in. pipe; valve boxes, Galvin Hydrant Co., Detroit, Mich. J. D. COOK, of Toledo, O., is the Consulting Engineer.

Warsaw, Ind.—Center Lake, from which the city draws its water supply, has become contaminated with crude oil, recently introduced by the water company for fuel at the pumping station. The water in the mains is so offensive that it cannot be used. The tank in which the oil is stored recently sprung a leak, and the fluid found its way into the lake, and the water has been tainted as far down as the Tippecanoe river. It will be impossible to purify the water inside of three months, and the use of hydrant water will have to be abandoned for the winter. The City Council will be petitioned at once to have the nuisance abated as soon as possible.

St. Paul, Minn.—The Board of Water Commissioners has received the annual reports from its officials for the year ending Nov. 30, 1888. During the year 28 miles of mains were laid, bringing the total to 131 miles. There are 234 meters in use. The charge for sprinkling the streets during the coming season will be 10 cts. per 100 ft. of street. The laying of a new 30-in. high service supply main is recommended. The bonded indebtedness of the city on account of the water-works is $2,160,000; annual interest on same, $106,800; total service connection, 7,335; of which 4,231 are low service and 3,004 are high service. There are now in use 1,134 fire hydrants, 162 street sprinkling hydrants and 1,199 gates.

Street Work and Sewers.—*Montreal, Canada.*—The report of the City Surveyor, PERCIVAL W. ST. GEORGE, on the various works executed by the Road Department during 1887, which report was presented to the Council on March 12, 1888, has been published. The appropriation for the year, $226,000, was quite inadequate for the requirements; the estimates of the Department were $304,405. There is much interesting information in regard to street paving, and details of the paving of London streets, with the cost of the work, are given. There has been much difficulty in getting sewer work properly done by contract and day work by the city is recommended. In proof of the "combine" of contractors, the following table is given of bids for sewer work in St. Jean Baptiste ward:

	1st Tenders.		2nd Tenders		Difference
Sanguinet St.	$25.00 per lin. yd.		$16.93 per lin. yd.		$8.07
Rivard St.	19.70	"	6.97	"	12.73
Maple St.	15.80	"	7.50	"	8.30
St. Hippolyte	27.75	"	19.25	"	8.50
Drolet St.	20.25	"	15.43	"	4.82
Laval Ave.	27.75	"	17.85	"	9.90

When the sewer for St. Hippolyte St. was ordered to be built by day work the contractor again offered to reduce his price from $19.25 to $17. The work was done by the city for $17.29, including the manholes and shaft connections, which the contractor did not include in his price, the work was only a short piece, 423 yds. and if the whole street had been done the price would have been still further reduced. During the year 11,580 lin. yds. of lateral sewers were built, making a total of 22.10 miles. The proposed arrangements for abolishing railway crossings are referred to. The report of F. B. LA VALLÉE, Deputy City Surveyor, contains details of the cost of street work, and there are also tables of descriptions of sewers, paving, etc.

Irrigation.—*New Mexico.*—The Pecos Irrigation & Investment Co. is pushing work on the Roswell and Eddy 30 miles irrigation canals. There are four "New Era" ditching machines, two on each canal, and they are found competent, under ordinary circumstances, to handle from 1,500 to 2,000 cu. yds. per day each. As compared with ordinary scraper work, it is found that each machine, drawn by 14 mules and operated by 3 men, is quite equal to 70 mules with scrapers and 40 men, and the cost of earth handled by them is not in excess of 2½ or 3 cts. per cu. yd. Surveyors are laying out the new town of Eddy. The streets will be 80 ft. wide, and several of the principal streets will be graded, and the ditches constructed in time for tree planting in the spring. The water power from the canal, which crosses the river at a height of 35 ft., will be utilized to raise the water from some large springs, about 1 mile north of the town, and that water will be distributed through acequias over the entire town site. CHAS. W. GREENE, the Manager, has located at the new town. The land along the route of the canals has been bought up very quickly. The water is now running in the Eddy ditch, a distance of 11 miles from the head of the canal, and is being distributed over some 2,000 acres, which are to be put in cultivation as rapidly as possible.

Niles, Mich.—The following particulars are sent us by a correspondent. The city contracted with a local company 13 years ago for 50 fire-hydrants at $50 each, and after using them for several years cancelled the contract on the ground that they had no right to make it, which the local court sustained. They continued using the works for fire purposes without pay, although the company offered to compromise on $25 per hydrant, but the city authorities insisted that $30 was an average of the country. Last week the water company removed the rods from the hydrants, and the city is now without fire service. The water is taken by gravity from Berrian lake, and is very pure.

Cullison, Kan.—The particulars given on p.518 (Dec.29 1888) as relating to the water-works at Rich Hill, Mo., refer to Cullison, Kan.; Rich Hill was merely the address of our informant, hence the mistake.

New Croton Aqueduct.—The following were the proposals for building dams Nos. 1 and 2 on or near Bog brook, in the town of Southeast, Putnam Co., N. Y., with adjacent tunnel, gate-houses, etc., in connection with the East Branch reservoir, which were received by the Aqueduct Commissioners, New York City, on Dec. 14: David R. Paige & Co., $351,750; John McQuade, $414,235; Howard Soule, $435,250; Rider & Dougherty, $443,385; Smith Brown & Coleman, $453,766.25; Virgilio del Genevese, $455,170; O'Brien & Clark, $463,575; John Sullivan, $472,150; Richard J. Malone, $473,350; Miles Tierney, $493,800; John Duffy, $505,485; Neilson & Co., $527,275; Evans & Ackerman, $543,640. The contract was awarded to D. R. Paige & Co.—The following proposals for furnishing all materials and doing all work necessary to construct the gate-house at Central Park Reservoir, laying the foundations, superstructure and substructure, constructing all chambers and appurtenances and laying all other work necessary to complete Section 17 of the new aqueduct, were also opened on Dec. 14: R. J. Malone, $33,946.25; John Pierce, $35,481.50; James D. Murphy, $39,666.50; List & Lennon, $40,315.95; O'Brien & Clark, $41,050.

Water-Works.—***Vermont.***—Brattleboro. The Chestnut Hill Reservoir Co. will extend its mains this spring into the part of the town not yet supplied. The capital stock of $250,000 has all been subscribed. President, GEO. E. CROWELL; Vice-President, E. P. CARPENTER; Treasurer, G. S. DAWLEY; Secretary, A. E. CUTTER.

Massachusetts.—Mansfield. The Water Commissioners have been authorized to issue $5,000 more water district bonds.—Holbrook. The works were finished in June, 1888, and there are now about 250 consumers; about $5,000 will be paid yearly toward discharging the debt.

Pennsylvania.—Myerstown. A movement has been organized to establish a water supply for the borough. The project has been endorsed by the citizens and a committee of ten appointed to report on the best source of supply and the probable cost. W. S. Urich is interested.—Greensburg. On Jan. 1, the supply main of the Westmoreland Water Co. was maliciously broken, cutting off the supply. This is the second time the main has been tampered with.

Georgia.—Atlanta. The artesian water has been analyzed and pronounced impure by the Health Board. An increased supply of water will soon be required. The supply is sufficient to keep up a pressure for fire purposes when needed, but the Water Commissioners will probably take into consideration at an early date recommendations heretofore made by Superintendent RICHARDS, and commence surveys looking to a more abundant supply.—A project is on foot to form a company to furnish water for factories. JACOB ELSAS is interested.

Alabama.—Tuscaloosa. The water-works were tested Jan. 3, with satisfactory results. Streams were thrown to a height of 90 to 100 ft. by stand-pipe pressure.

Tennessee.—Pulaski. The vote on the proposition to put in water-works has resulted favorably, and the works will be built by the city as soon as the Legislature has authorized the issue of bonds. The works will cost between $30,000 and $40,000. For particulars address the mayor, T. H. MAY.

Ohio.—Leetonia. An enabling act is to be secured from the Legislature to authorize the construction of the projected works, and until this is obtained all action will be postponed.

Michigan.—Mount Clemens. The water-works have recently been completed and put in operation.

Illinois.—Chicago. Mayor ROCHE has a scheme for a high service water supply and recommends appropriating $500,000 from the water fund for starting the scheme.

Kansas.—Baxter Springs. Works are not yet constructed. The franchise will be owned by private parties. A dam is put in and power ready for use.

Nebraska.—Holdrege. The works are nearly completed; the system will have cost $60,000. A suggestion has been made that the city should own and operate the system.—Lincoln. More water has been flowing from the Antelope well than the pump could dispose of and the sinking has been delayed. It is intended to put the well down about 10 ft. more.

Canada.—Goderich, Ont. The water-works are nearly completed. The supply will be drawn from a series of artesian wells about 850 ft. deep.

Special Reports of Water-Works Construction.

Apollo and Horatio, Pa.—We have received from R. B. THOMAS, Clarion, Pa., data regarding these two systems. Each was constructed in 1888, with Mr. THOMAS as contractor. The Horatio works are owned by the Reynoldsville Water Co., and were designed by GEO. MILINGER. The other system is owned by the Apollo Water Co., and the pipe and specials were furnished by the National Foundry Co., Scottdale, Pa., and a Keystone pump is used. At Horatio an Epping pump has been put in, and the pipe and specials were from R. D. Wood & Co., Philadelphia, Pa. W. L. THOMAS is Superintendent at Horatio, and S. T. STRINGFELLOW at Apollo.

Ft. Robinson, Neb.—OMAHA, Neb., Jan. 3, 1889.

EDITOR ENGINEERING NEWS:—The U. S. Government will construct works at Ft. Robinson this year. Water from springs will be impounded, then pumped by a Knowles duplex pump with a daily capacity of 200,000 galls. to tank; the latter will have a capacity of 95,000 galls., and will have an elevation of 60 ft. above distribution. The pump is in place, but the contracts for pipe, tank, valves and hydrants have not been let. There will be one mile of 6-in. cast-iron pipe, 29 taps, and 7 hydrants. The services will be of wrought-iron.

WM. B. HUGHES,
Major & Quartermaster, U. S. A.

CORPUS CHRISTI, Tex., Jan. 2, 1889.

EDITOR ENGINEERING NEWS:—The city has contracted with the American Well Works Co., Aurora, Ill., for the boring of an artesian well with a minimum daily yield of 50,000 galls. As soon as water is found contracts will be let for a complete system of water-works. Water will be pumped to a stand-pipe on a hill 60 ft. above and 600 ft. from the pumps. A special tax has been voted and $35,000 of 8 per cent. bonds will be issued to pay for the works. The bonds will be guaranteed by the State.

JULIUS HENRY.

Falls City, Neb.—We have received the following information regarding these water-works from W. KIERSTED, of Kansas City, Mo. The works were begun March 1, and completed Sept. 6, 1888, at a cost of $28,000, covered by 5 per cent. city bonds. The contract for works complete was let to S. K. Felton & Co., of Omaha, Neb., with W. KIERSTED, as designing and constructing engineer. The source of supply is ground water, which is pumped by a 1,000,000-gall. duplex, non-compound, non-condensing, Knowles' pump, to a stand-pipe 12½ ft. in diameter and 100 ft. high. Pipes and specials were furnished by the Shickle, Harrison & Howard Iron Co.; the valves by the Ludlow Valve Mfg. Co., and the hydrants are of the "Eclipse" pattern. There are 3 miles of 4, 6, 8 and 10-in. cast-iron mains and 23 fire hydrants; there is an ordinary pressure of 40 lbs. and a fire pressure of from 86 to 100 lbs. The works are owned by the city, which has a population of 3,000.

Superior, Neb.—The following particulars received from S. K. FELTON, Omaha, who had contract for the works complete, are given addition in to facts published in our last issue. The works were begun Oct. 1, with W. KIERSTED, as designing engineer and are now nearly completed. S. K. FELTON had charge of their construction. The two 500,000-gall. compound pumps were furnished by the Deane Steam Pump Co., boilers by the Pond Engineering Co., pipes and specials by Ripley & Bronson, and the valves and hydrants by the Chapman Valve Mfg. Co. Water is pumped from a well direct to mains (we stated last week to a reservoir, as we were then so informed,) through 3 miles of 4, 6, 8 and 10-in. cast-iron pipe. There are 80 taps, 20 hydrants, an ordinary pressure of 40 lbs. and a fire pressure of 125 lbs. The cost of the works was $27,000, which was raised by issuing that amount in 5 per cent bonds.

CHEHALIS, Wash. Ter., Dec. 29, 1888.

EDITOR ENGINEERING NEWS:—Work has recently been begun on a system of water-works for this place by the Chehalis Water Co., and will be finished about July 4, 1889. The designing and constructing engineer is H. A. RAY, who is also superintendent. Water will be pumped direct to mains and to a 100,000-gall. reservoir, by a 100,000-galls. duplex pump. There will be 5 miles of 6 and 8 in. wood and cast-iron mains, an ordinary pressure of 43 lbs. and a fire pressure of 86 lbs. The company has a capital stock of $20,000, which is to be the cost of the works. The officers are JOHN DOBSON, H. A. RAY, J. W. PARR and W. T. FORREST.

JOHN DOBSON.

KENT, Wash. Ter., Dec. 29, 1888.

EDITOR ENGINEERING NEWS:—Contracts for the construction of water-works in this place, will be let in April, 1889, by the Kent Water Supply Co. (not yet incorporated,) of which C. E. GUIBERSON will probably be managing director and the writer the secretary. The source of the proposed supply is from springs in the hills, one mile distant, and the probable cost $10,000. Water is now obtained from a reservoir. Population, 400.

W. J. SHINN,

SPRAGUE, Wash. Ter., Dec. 29, 1888.

EDITOR ENGINEERING NEWS—Water-works to be owned by the city will be constructed in the spring. Water will be pumped to a 100,000-gall. reservoir, 25 by 70 by 8 ft. deep.

W. B. LOTHMAN.

SANTA ANA, Cal. Jan. 2, 1889.

EDITOR ENGINEERING NEWS:—This city began the construction of a system of water-works in Oct., 1888, to be completed in June of this year, at a cost of $50,000, which amount was raised by issuing 6 per cent. bonds. W. R. COATS was designing and constructing engineer. The contract for the 1,500,000-gall. duplex compound pump and for hydrants, was awarded to the Holly Mfg. Co. Lockport, N. Y.; for pipes and specials, to Shickle, Harrison & Howard, of St. Louis, Mo., for valves to the Frontier Iron Co. The water is pumped from an artesian well direct to the mains, but ultimately a 250,000-gall. stand-pipe, at 100 ft. elevation, will be used. There will be 7 miles of mains, 33 hydrants, an ordinary pressure of 50 and a fire pressure of 80 to 90 lbs. The city has a population of 6,000.

W. R. COATS.

BAKER CITY, Oregon, Dec. 25, 1888.

EDITOR ENGINEERING NEWS:—The construction of water-works to be completed in the spring, was begun Nov. 1, and excavations for pipe have been made by J. C. WHITE, who has the contract. Water will be obtained from a well, and pumped direct to mains, and to a 500,000-gall. reservoir 150 ft. above the city, by a Worthington compound duplex pump. There will be 2 miles of 6, 8 and 10-in. mains and 14 hydrants. The works will cost $30,000, which will be raised by issuing bonds. Population, 3,500.

J. T. DONNELLY, *City Auditor.*

GRAND JUNCTION, Col., Dec. 25, 1888.

EDITOR ENGINEERING NEWS:—The Grand Junction Water Co. began to build its works Dec. 1, 1888, with J. S. SIMMONS as designing and contracting engineer. The work will be completed April 1, 1889. The franchise is for 20 years. There is a capital stock of $60,000. The officers are: President, W. G. REEVE, Peru, Ill.; Secretary, W. J. PARK, LARNED, Kan. Water will be pumped from the Grand river by a 1,500,000-gall. Knowles pump to a stand-pipe 10 ft. in diameter, and 100 ft. high. There are 50 hydrants, for which the city pays a yearly rental of $3,250. There are 4 miles of iron and cement mains. Population, 1,500.

H. J. KRUSEN, *Superintendent.*

ELECTRICAL.

Electric Light.—***St. Johnsbury, Vt.***—The Thomson-Houston Co. will put in a street lighting plant.

Newark, N. Y.—The Village Board has awarded a contract to Moffett, Hodgkins & Clarke, of Watertown, N.Y., for a plant with 35 arc lights for street lighting. The contract is for 5 years, at $2,400 per year.

Pittsburg, Pa.—A three years contract has been made by the city with the East End Electric Co.

Reading, Pa.—The City Council has awarded the contract for lighting the streets for 1 year, to the Reading Electric Light Co.; arc lights, $146 or $164.25 per year for all dusk hours or for all night and every night; incandescent lights, $28.28 or $31.92.

Philadelphia, Pa.—The Electric Bureau has awarded contracts as follows for furnishing electric lights during the year; the companies control different territories: Germantown Electric Light Co., 55 cts. a lamp; Frankford Electric Light & Power Co., 55 cts.; Northern Electric Co., 48 cts.; Brush Electric Light Co., 45 to 50 cts.; United States Electric Light Co., 49 cts.; Philadelphia Electric Light Co., 45 to 47½ cts.; Wissahickon Electric Light Co., 55 cts. The appropriation is $130,000.

Milwaukee, Wis.—The Western Electric Light Co. has been organized by HENRY C. PAYNE, FRED. T. DAY and WM. PLANKINTON. Capital stock, $100,000.

Madison, Wis.—An electric light franchise has been granted to GEO. W. GILMAN, JOHN W. HUDSON and CARL HAUSMANN.

Portland, Ore.—The Willamette Falls Electric Light Co. has put in a Thomson-Houston plant.

Truckee, Cal.—The Truckee Electric Light & Power Co. will put in additional dynamos and an incandescent plant. The plant is driven by water power. C. F. McGLASHAN is Superintendent.

San Jose, Cal.—The Brush Electric Light Co. has been granted a franchise for 3 years.

San Francisco, Cal.—The Harbor Commissioners have awarded the contract for lighting the water front to the Electric Improvement Co.; there will be 12 lights of 2,000 c. p. at $3.15 each. The California Electric Light Co. bid $3.85.

Goderich, Ont.—The city is now lighted by 50 electric lights. The plant was put in by the Reliance Electric Mfg. Co., of Waterford, Ont.

New York City.—The Edison Illuminating Co. is now prepared to furnish electric current for light or power from its new central stations on W. 26th St. and 39th St. The amount of current used is measured by an Edison meter placed on the premises of the consumer, who pays only for the amount used. The main lines are underground, with underground service connections; the company lays the connections, supplies the meters and renews all lamps as they burn out.

Electric Companies.—The Westinghouse Electric Co. has a contract for an arc and incandescent light plant for one of the suburbs of Rio de Janeiro, Brazil.

The Stout Electric & Storage Battery Co., of New York, capital stock $300,000, is building a large factory at Red Bank, N. J.

The Heisler Electric Light Co., of St. Louis, Mo., has its system in use in 36 cities, representing a total investment of $1,500,000.

The Edison General Electrical Co. has been incorporated in Essex Co., N. J., with a capital stock of $12,000,000. The works will be at West Orange. The company is formed to consolidate the Edison Machine Works, at Schenectady, N. Y., which manufacture the Edison dynamos, etc.; the Edison Lamp Co., of Harrison, N. J., which manufactures the incandescent lamps; Bergman & Co., of New York, who make the fixtures, and the Edison Electric Light Co., of New York.

Phonographs.—The North American Phonograph Co. has acquired from JESSE H. LIPPENCOTT the right to deal in the Edison phonographs, which rights he purchased some months ago for $1,000,000. The instruments will be made by the Edison Phonograph Co., of West Orange, which has the sole right to manufacture them.